Oikos

o20283

Raynaud, X., Jones, C. G. and Barot, S. 2013. Ecosystem engineering, environmental decay and environmental states of landscapes. – Oikos 122: 591–600.

Appendix A1

Organismal movement within the landscape

As pointed out in Model development, the model does not consider engineer movement within the landscape. We evaluated the degree to which movement qualitatively affected model outcomes using simulations based on a modified version of the general model (Eq. 6, 7). For each simulation run, at each time step, a fixed proportion of engineers, varying between 1 and 25% of the population in each environmental state, was designated as mobile and redistributed to other states based on two contrasting patterns that represented random or environmental state-dependent movement. Random movement was simulated by distributing all mobile organisms to all other states according to the proportions of each of those states; the greater the proportion of an environmental state in the landscape, the greater the number of organisms moving to that state. A simple representation of environmental state-dependent movement was simulated by transferring all mobile organisms to the least engineered state (N_1), thereby decreasing the modification and maintenance of engineered states. Although movement had quantitative effects on landscape average environmental states and heterogeneities (e.g. changes in the variance of model outputs), the overall behaviour of the model was not altered by either kind of movement pattern, even when a relatively large proportion of organisms (25% for random movement; 10% for state-dependent movement) were moved at each time step (compare Fig. 4a and b with Fig. A3a and b and Fig. 3a with Fig. A3c).

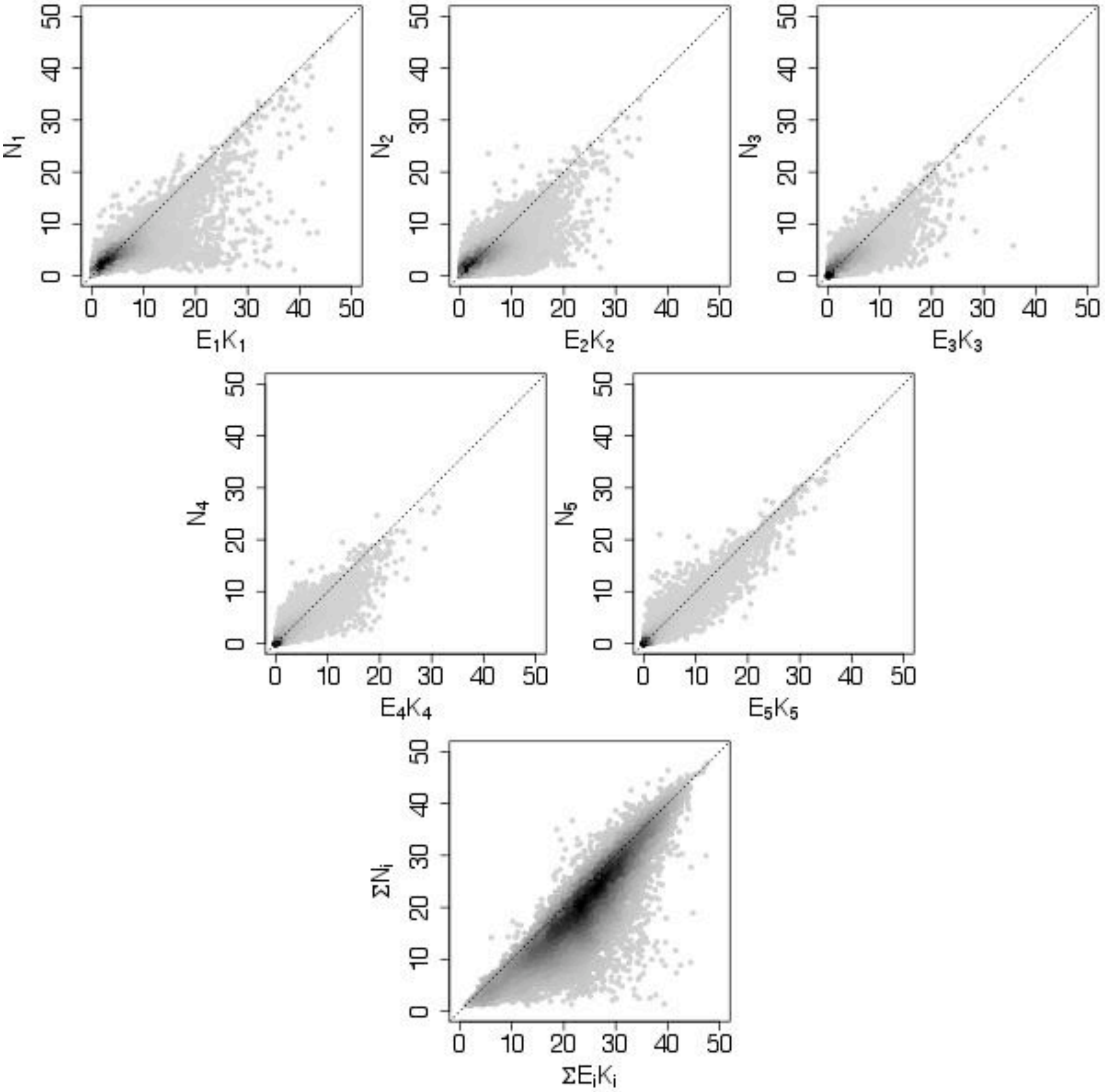

Figure A1. Relationships between realized (N_i) and expected (K_iE_i) engineer population sizes in each environmental state (subscript 1–5), and the entire landscape ($\sum$). In each panel, the dotted line is the 1:1 line. Each data point is the result of one simulation. Shading indicates data point density. Regressions between N_i and E_iK_i for states $i = 1,..,5$ have R^2 values of 0.60, 0.55, 0.63, 0.75, 0.75, respectively. The regression for the entire landscape has an R^2 value of 0.73.

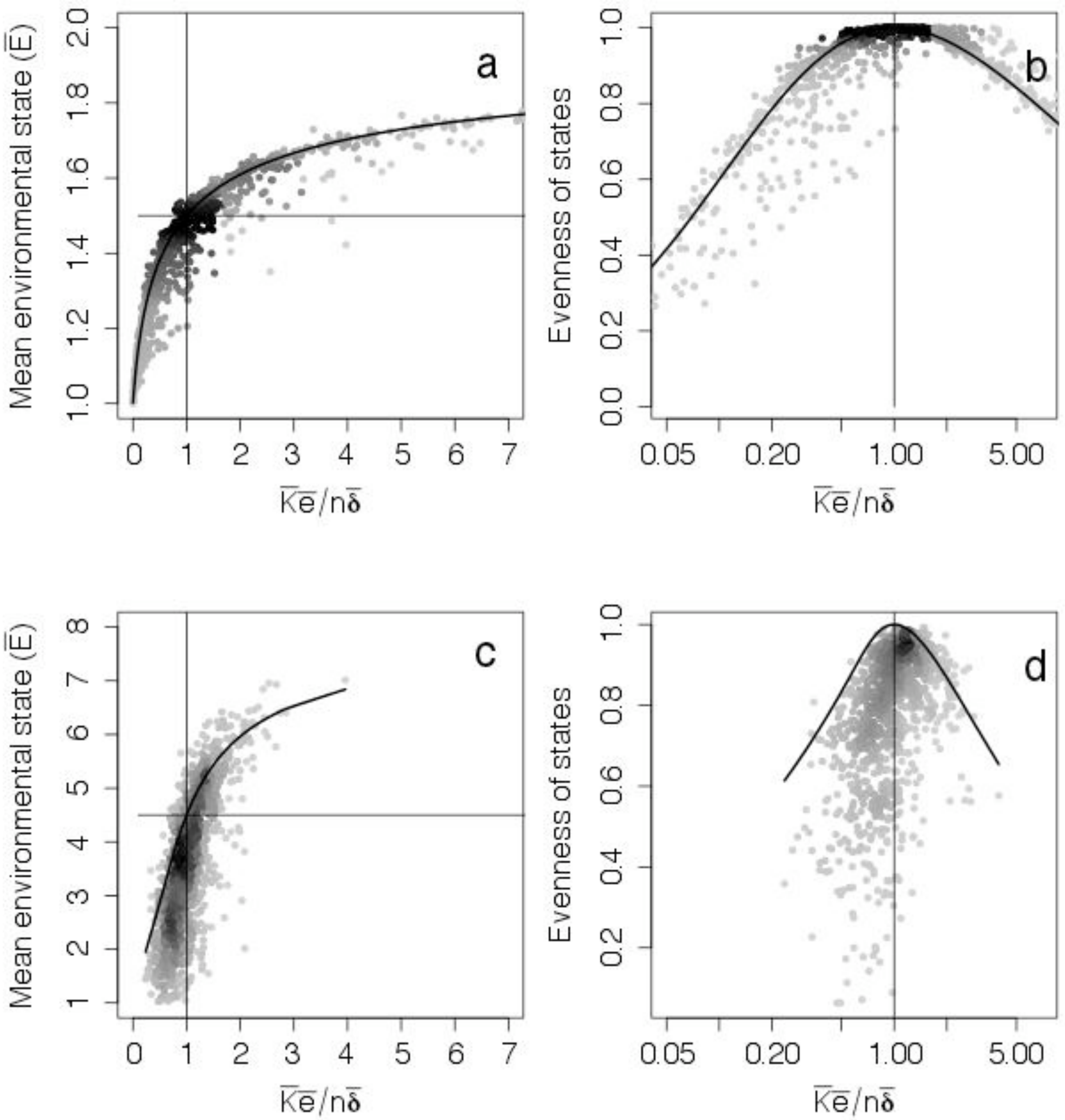

Figure A2. Relationships between mean environmental state of landscapes and NER (a, c) and evenness of environmental states and NER (b, d) in the case of a model with 2 states (a, b) and 8 states (c, d).

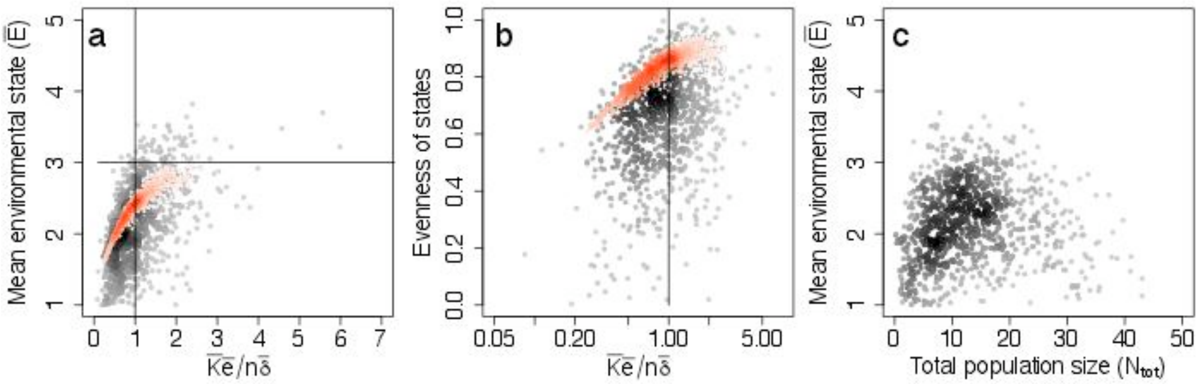

Figure A3. Relationships between (a) mean environmental state of landscapes and NER, (b) evenness of environmental states and NER and (c) mean environmental state of landscapes and total population size. For the case of 5 states, and where 25% of engineers of all states where moved to state 1 at each time step. Grey points correspond to simulations in the FR set whereas red points correspond to simulations in the AF set.

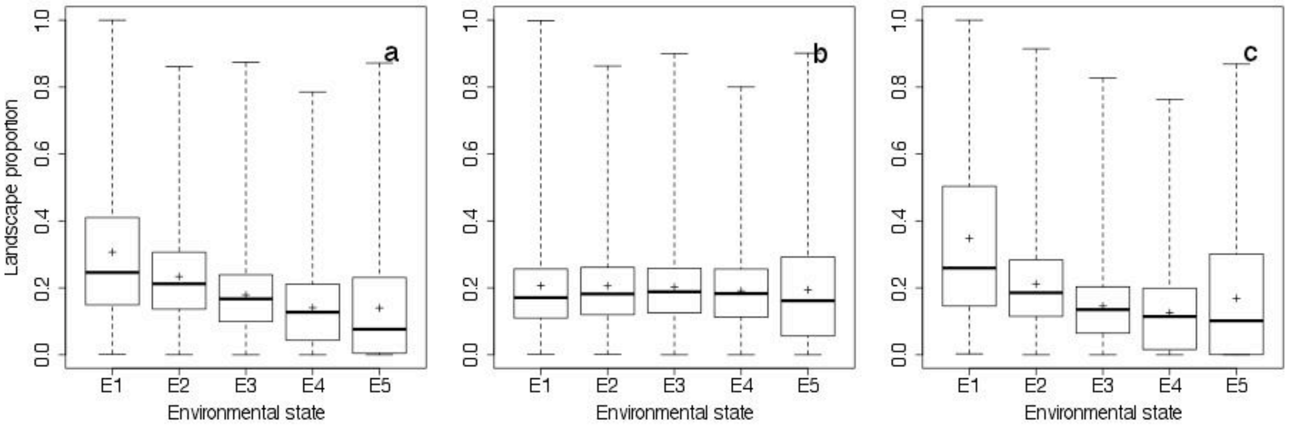

Figure A4. Proportions of the different environmental states across all simulations of the FR set (a), NF set (b) and PF set (c).

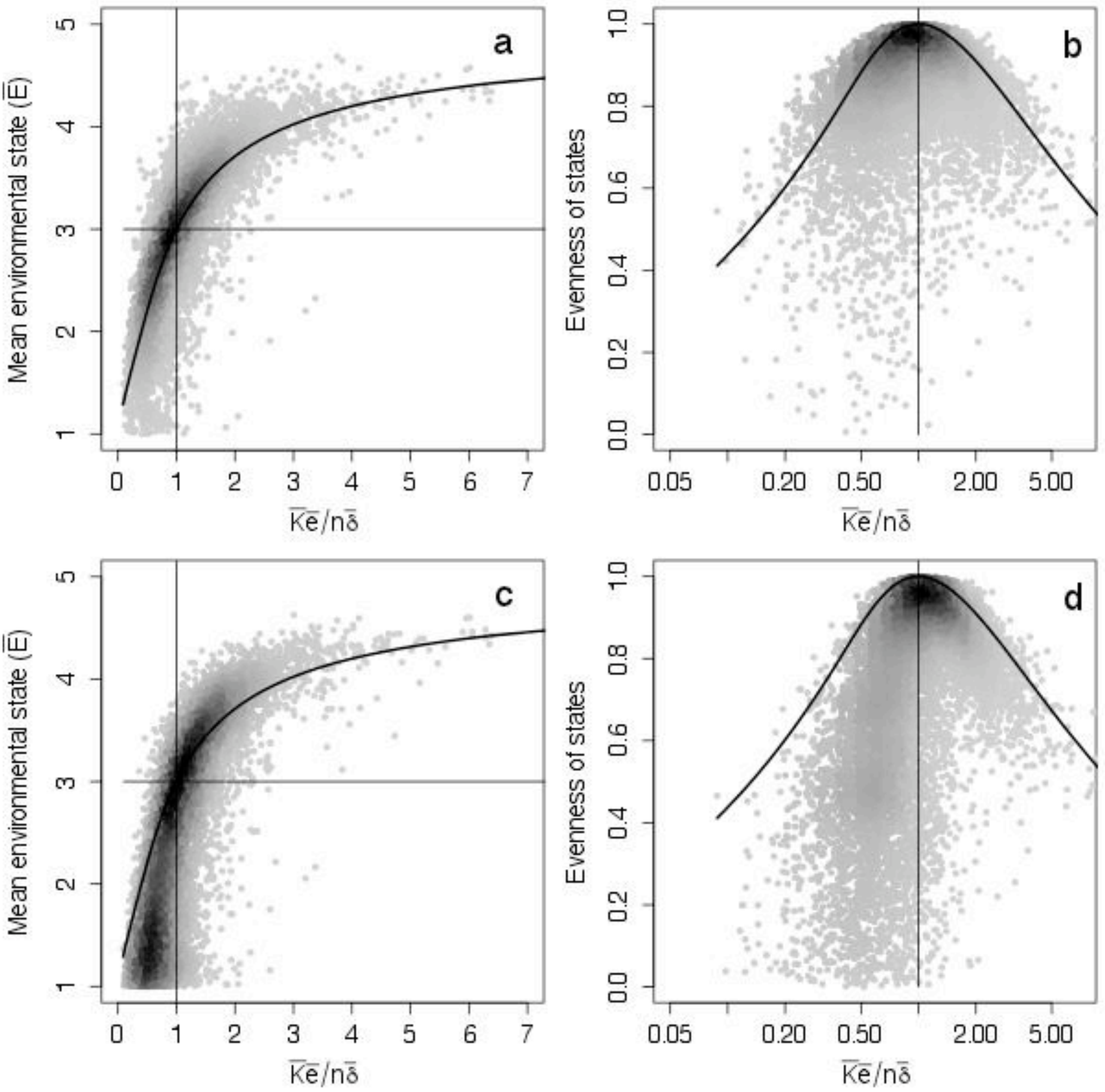

Figure A5. (a) and (c), relationship between mean environmental state of landscapes and NER for the case of 5 states. Thin vertical and horizontal lines show where NER = 1 and the average state is equal to the intermediate state =(n + 1) / 2; (b) and (d), relationship between landscape environmental heterogeneities as evenness of environmental states, and NER. Note the logarithmic scale of the x-axis. Each data point is the result of one simulation. Shading indicates data point density. Panels (a) and (b), corresponds to the NF set, panels (c) and (d), to the PF set. The thick line on all graphs is the AR set.