Oikos

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Supplementary material

Supplementary information to "The degree of spatial variation relative to temporal variation influences evolution of dispersal"

2020

1 Landscapes

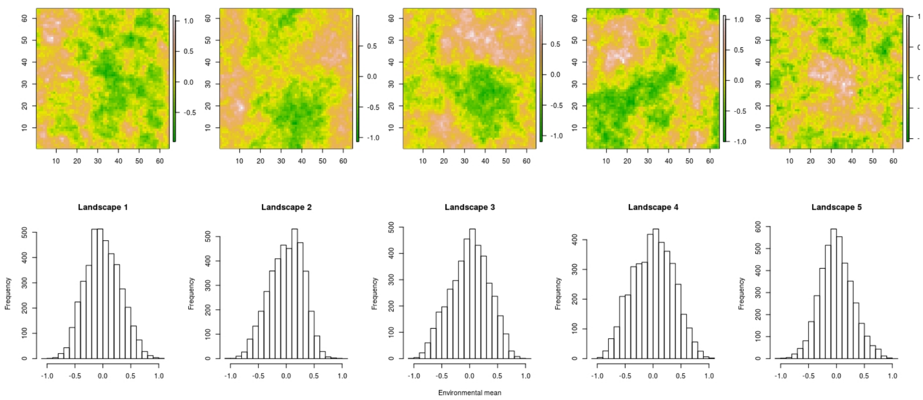

Figure S 1: The five different landscapes used in the simulations with the corresponding habitat frequency distributions (sd = 0.32). Landscapes with different sd were generated by multiplying each habitat attribute with a factor, so that the shape of the frequency distributions was not altered. The landscape shown in Figure 1 of the manuscript is landscape 5.

2 Tolerance trait values

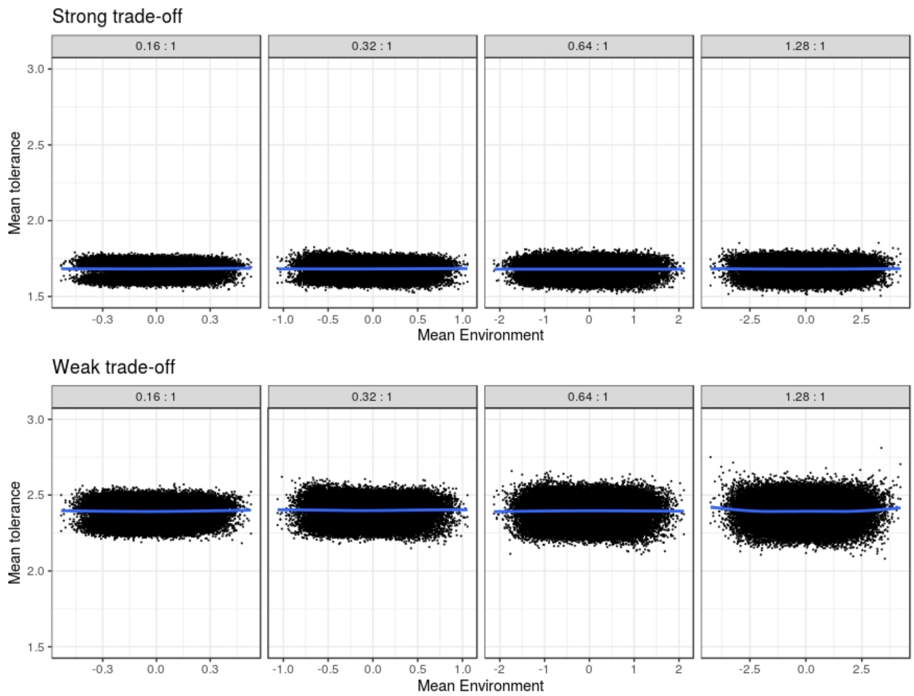

Figure S 2: Mean tolerance trait value calculated in the last generation for each patch plotted over the patches' mean H environmental attributes. Panels show values for four degrees of spatial variation (increasing from left to right) and two trade-off strengths (top row for strong, bottom row for weak trade-off). Spatial variation is labeled relative to the temporal variation of $H = 1$. No difference in trait values between degrees of spatial variation can be seen, but a quantitative difference between the trade-offs strenghts is visible. As expected, a stronger trade-off leads to the evolution of lower tolerances.

3 Temporal change

Three different time series for environmental fluctuations utilized in comibination with the five different landscapes to create the 15 replicate simulation runs for each scenario. As shown below, the second time run had the higher range of values and contained more extreme events then the other two iterations. This influenced the geometric mean fertility (see figure S 4).

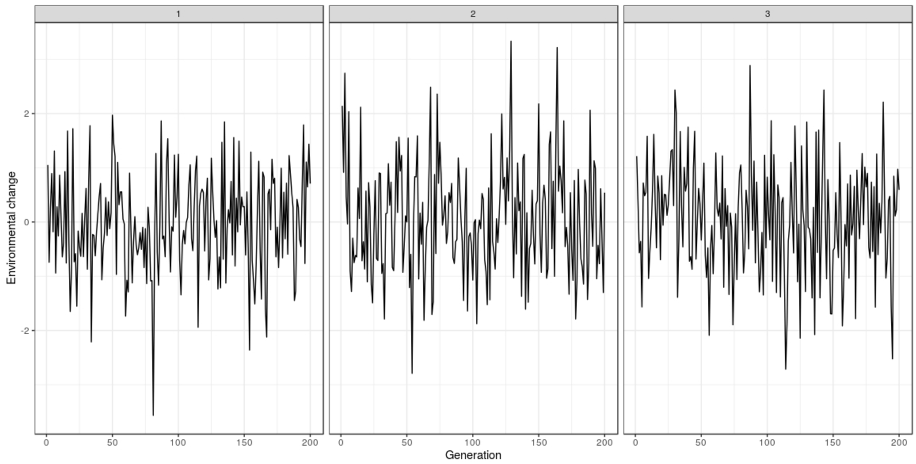

Figure S 3: The annual environmental change plotted over the respective generation it occured in, for three iterations.

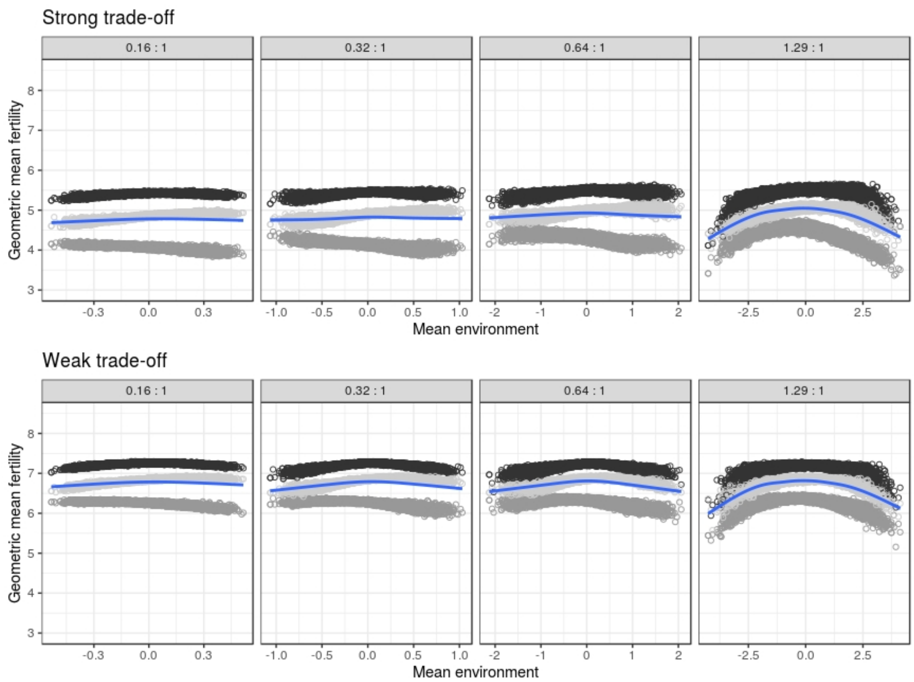

Figure S 4: Geometric mean fertility for populations in habitats of different attributes. Panels show combined data from all 15 replicate simulation runs. The influence of the three different temporal variation runs is clearly visible in the grey shading. The lowest fertility corresponds with iteration number 2 (dark grey) in figure S3.

4 Results for a strong trade-off

In the manuscript, we show only the results for a weak specialist-generalist trade-off, since the results for a strong trade-off are qualitatively the same. The following figures show the results for a strong trade-off, structured similarly to the figures in the manuscript.

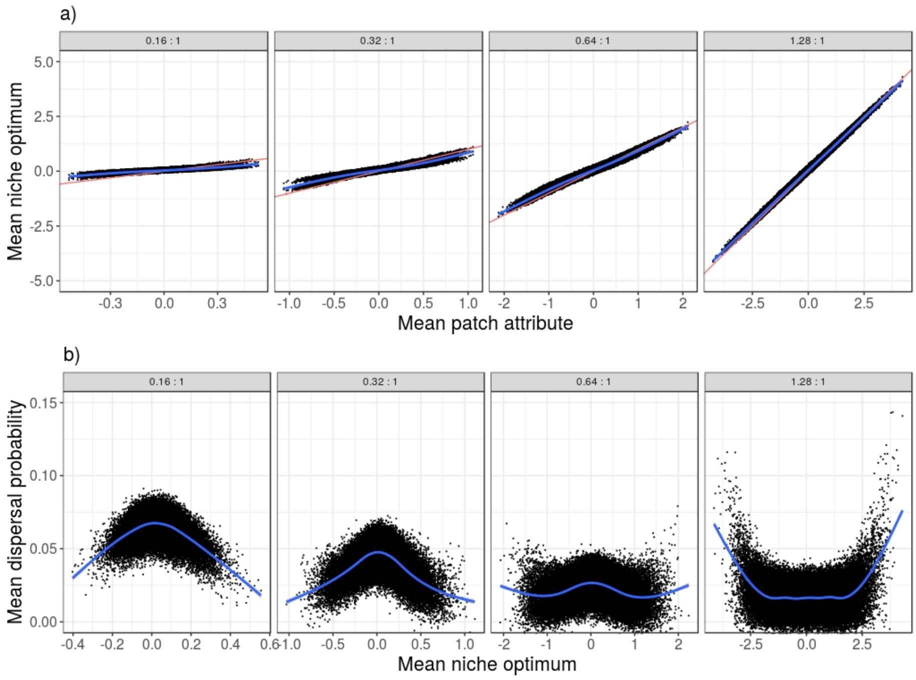

Figure S 5: a) Mean niche optimum trait value calculated in the last generation for each patch plotted over the patches' mean environmental attribute σ_S . Panels show values for four degrees of spatial variation, which increases from left to right and is labeled relative to the temporal variation of $\sigma_T = 1$. Mean niche optimum trait values (fitted blue line) approximate the patches' mean environmental attribute (red line). b) Mean dispersal trait value of each patch plotted over the mean niche optimum trait value of the respective patch evolving by the end of the simulation. Data points from pooled data from the 15 replicate simulation runs for each scenario. Arrangement and classification of panels as in panel a).

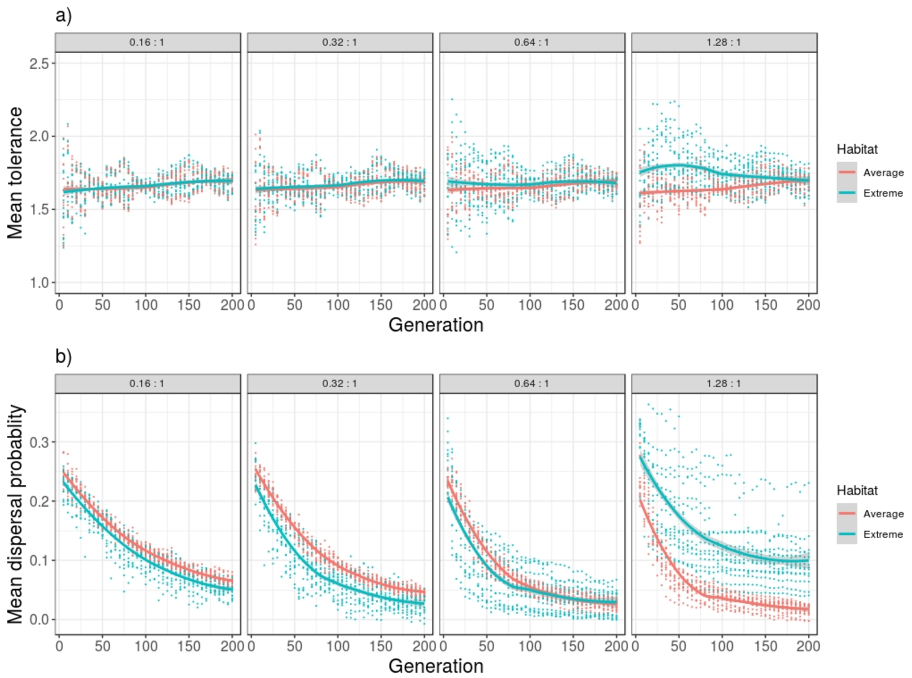

Figure S 6: a) Patch-wise mean tolerance values over time, starting in the fifth generation for two patches per landscape. For each of the 15 replicate simulation runs (5 landscapes x 3 time series) the patch with the most extreme habitat (the patch with the highest absolute value for the habitat attribute; blue dots and line) and the patch closest to average conditions (the patch with the lowest absolute value for the habitat attribute; red dots and line) are shown. b) Change in patch-wise mean dispersal probability trait values over time, starting in the fifth generation for average (blue dots and lines) and extreme habitats (red dots and lines). Arrangement and classification of panels as in Fig. 4

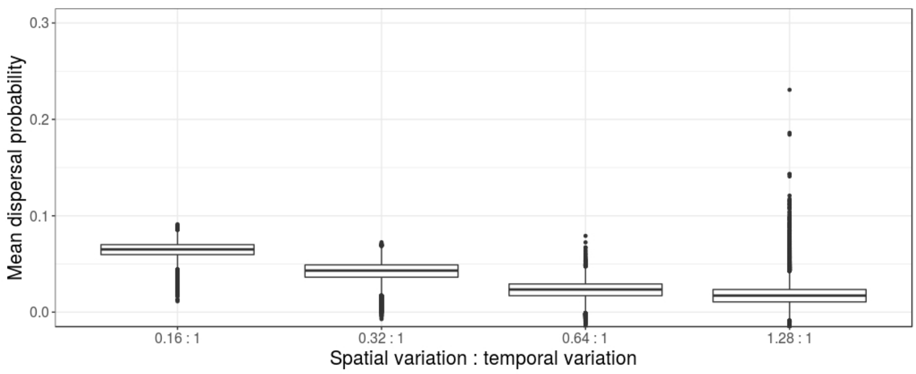

Figure S 7: Box-plot of mean evolved dispersal traits values (averaged over 15 replicate scenarios) for the different degrees of spatial variation. Spatial variation increases to the right and is labeled relative to the temporal variation of 1.

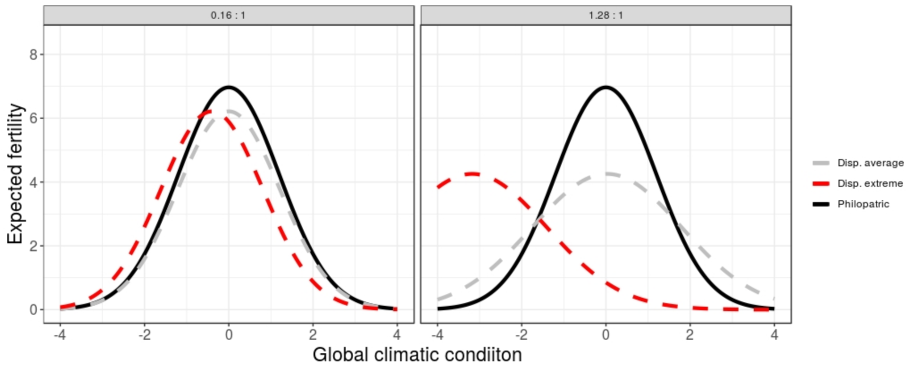

Figure S 8: Expected mean fertility for individuals either remaining philopatric and adapted to the patch of origin ($h_i = \bar{H}_j$) in dependence of actual climatic condition (black line) or randomly dispersing, accounting for 10% dispersal mortality. Grey hatched line for individuals adapted to and emigrating from an average patch ($H_j = 0$) and red hatched line for individuals adapted to conditions -2.5 spatial standard deviations below the spatial mean (cold adapted). Top row shows values for the strong $\alpha = 2$, bottom row for the weak trade-off ($\alpha = 4$), left column shows values for the lowest spatial variation (sd = 0.16), the right column for the highest spatial variation (sd = 1.28).