 DOI: 10.1086/680220

Appendix F from S. Peischl et al., "Expansion Load and the Evolutionary Dynamics of a Species Range" (Am. Nat., vol. 185, no. 4, p. 000)

Alternative Models of Hard Selection

Mean Fitness Affects Growth Rates

If mean fitness affects growth rates but not carrying capacities, the dynamics of mean fitness on the wave front (fig. F1), the dynamics of the species range (fig. F2), and the dynamics of D_f and B_f (fig. F3) are very similar to the case studied in the main text. This is not surprising because carrying capacities have only a minor effect on the dynamics of the expansion (see, e.g., Hallatschek and Korolev 2009). The main difference from the results reported in the main text is that population sizes remain constant on the wave front, which increases the efficiency of selection. The equilibrium mean fitness on the wave front is then given by

$$\tilde{\bar{w}}_f = \frac{1}{R_0}\left[\left(\frac{K_0}{F_0}\right)^{4Fs/\{\log[\varphi_d/(\varphi_d-1)]\}}\right] = \frac{1}{R_0}\left\{1 + \frac{4F_0\log(K_0/F_0)}{\log[\varphi_d/(\varphi_d-1)]}s + O(s^2)\right\},$$

which is very similar to but larger than equation (5).

Mean Fitness Affects Carrying Capacities

If mean fitness affects only population size but not growth rates, the dynamics of mean fitness are very similar to the case of soft selection, where mean fitness on the wave front decreases indefinitely (Peischl et al. 2013). The main difference is that the expansion load eventually leads to a mutational meltdown such that front populations become extinct, and populations from the wake of the wave can expand into the newly available demes (fig. F5). Again, the expansion speed approaches a constant equilibrium value. This behavior is not observed in the analytical model (fig. F4), because we do not account for population extinctions or gene flow from the core of the species range.

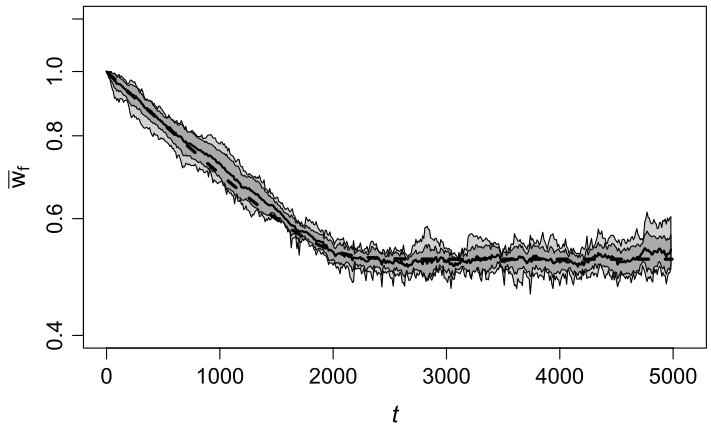

Figure F1: Evolution of mean fitness at wave front if mutations affect growth rates but not carrying capacities. Parameter values are as in figure 1*B*, and color code is the same as in figure 5.

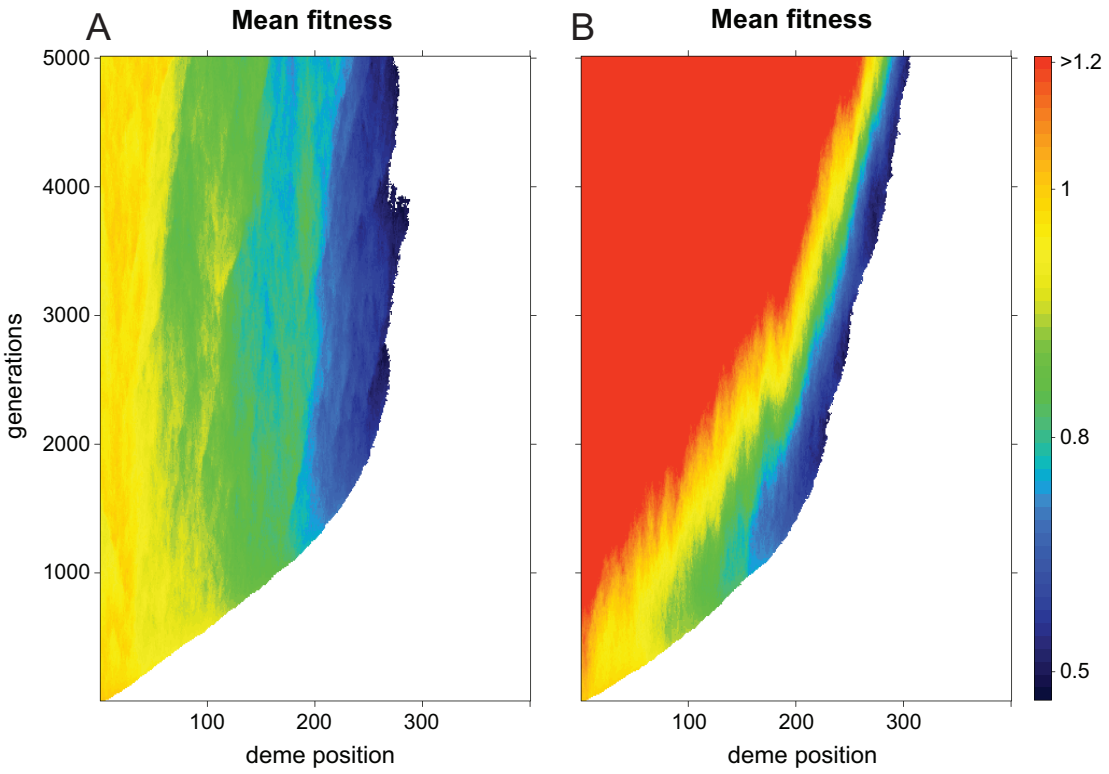

Figure F2: Evolution of mean fitness during range expansion when mutations affect growth rates but not carrying capacities. Parameter values are as in figure 1.

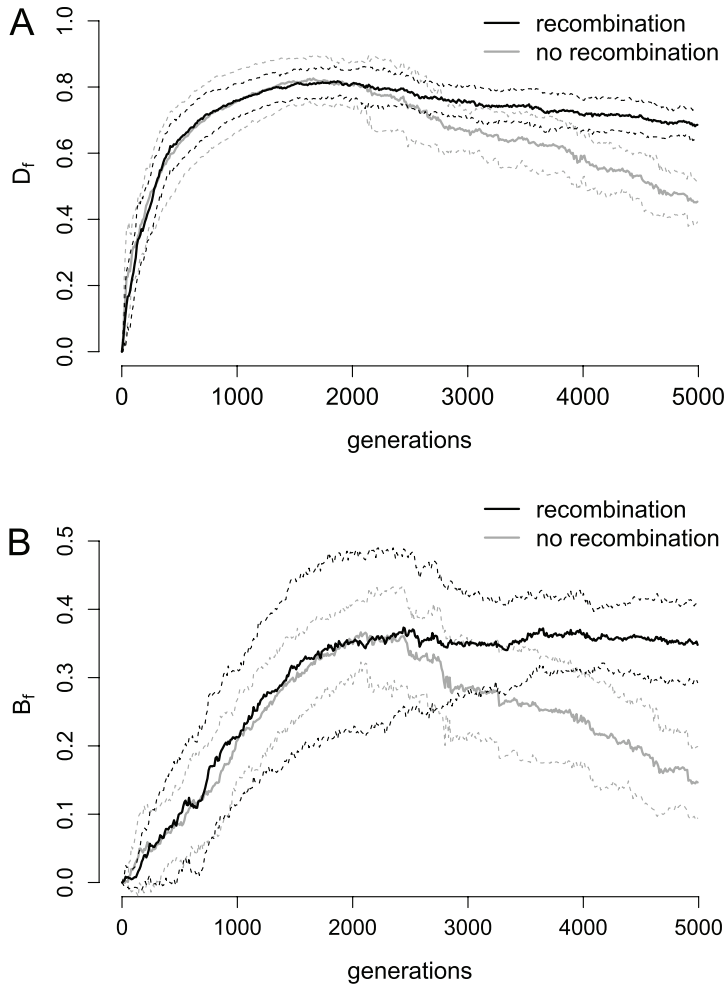

Figure F3: Evolution of the composition of the number of deleterious or beneficial mutations on the wave front, denoted D_f and B_f, respectively. Mean fitness affects growth rates but not carrying capacities. Solid lines show the fraction of the total number of mutations that is due to mutations originating on the wave front, and dashed lines indicate ± 1 SD. Parameters are as in figure 1.

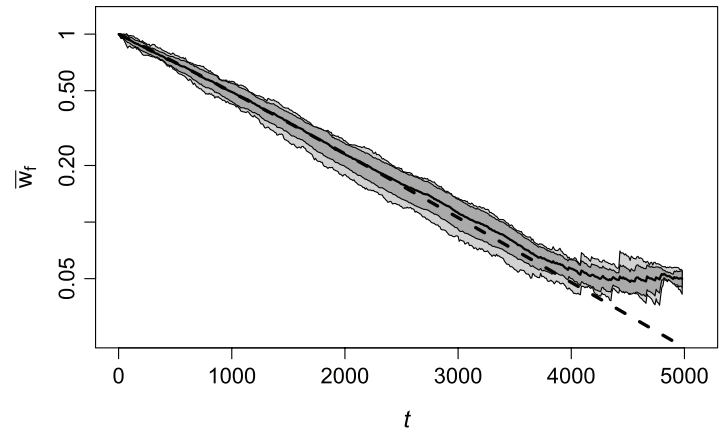

Figure F4: Evolution of mean fitness at wave front if mutations affect carrying capacities but not growth rates. Parameter values are as in figure 1*B*, except that $u = 0.1$, and color code is as in figure 5.

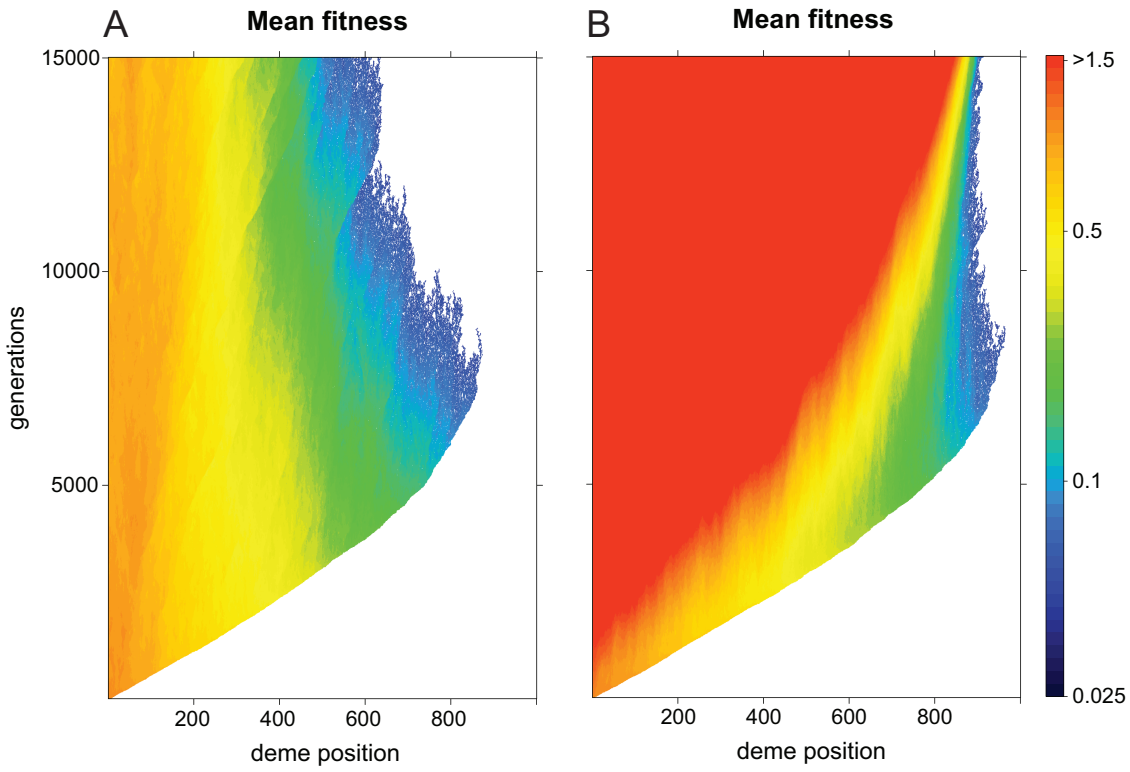

Figure F5: Evolution of mean fitness during a range expansion if mutations affect carrying capacities but not growth rates. Parameters are as in figure 1.

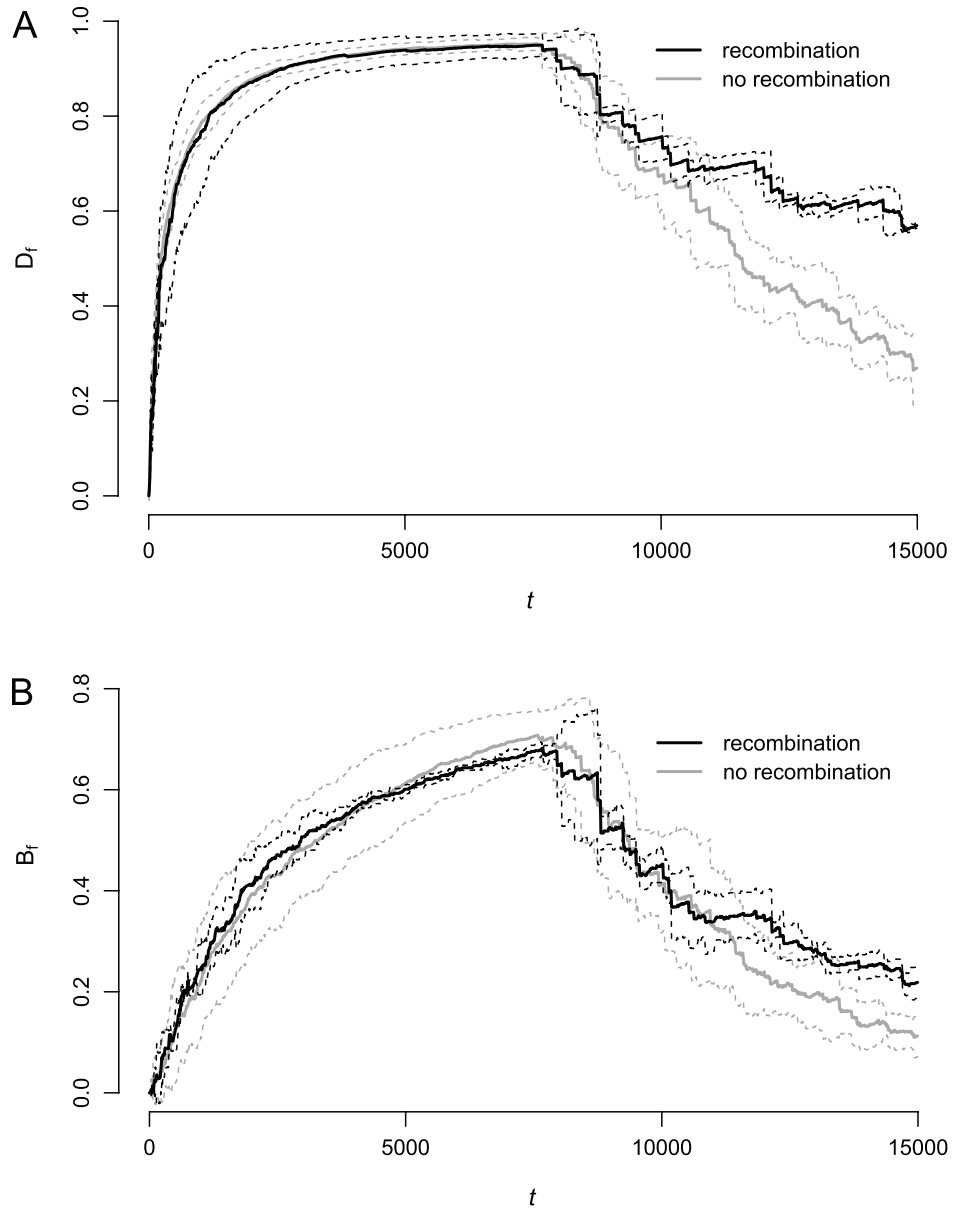

Figure F6: Evolution of the proportion of deleterious or beneficial mutations on the wave front, denoted D_f and B_f, respectively. Here, mean fitness affects carrying capacities but not growth rates. Solid lines show the fraction of the total number of mutations that is due to mutations originating on the wave front, and dashed lines indicate ± 1 SD. Parameters are as in figure 1.