Ex. 7
4. Threshold of a Contagious Disease

For self sustaining infection dynamics to arise, we need to make sure the disease does not go extinct. In the case of the initial condition, the initial density must therefore be high enough. This should play no role in the cases of temporally spread infections over Δt. We would expect the initial density not to influence the asymptotic value of densities, provided it is high enough to guarantee survival of the disease.

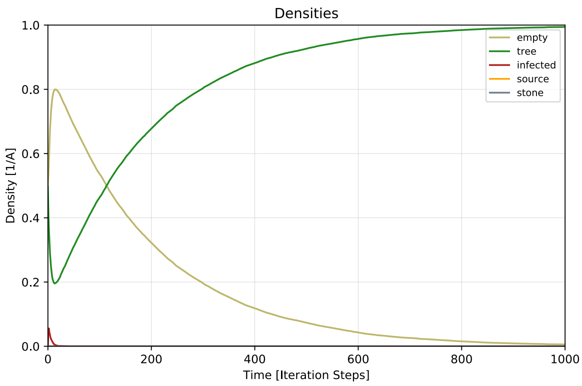
For possible asymptotic values of rho(t) we would expect either outcomes where rho goes to one after the disease has gone extinct, or where rho goes to intermediate values and oscillates like in the predator prey model. These outcomes depend on the infection mode, number of additional infections and on the growth rate. In general, we expect no qualitative difference between a deterministic infection mode and a fully probabilistic one. Making the Contagious Disease model self-maintaining might be somewhat more difficult in the pure initial condition setup as an extinction of the disease seems more likely.

We find in the simulation focusing on the initial condition setup, that stable infection dynamics crucially depends on the growth rate. If it is too low, the disease dies out. If it is very high, the disease

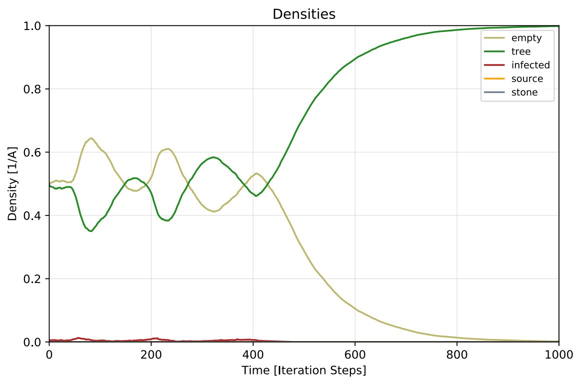
Similarly, if the number of initial infections is too low, it might die out, if it is too high, it might kill too many hosts and die out as well. For the initial density one has to strike a similar balance.

simulations:
128x128 grid throughout, initial infections N=200
The most important control parameter appears to be p_growth with N and the initial density having only a small effect on the simulation outcome.

p_growth very low (0.005)



higher p_growth (0.01)



p_growth high enough (0.05)