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Average population size of single species diffusing in heterogeneous environments

Extending previous research on how environmental heterogeneity influences population dynamics, in this talk we analyze how spatial diffusion affects the total population of a species evolving accordingly to the logistic equation. We consider that the species' intrinsic growth rate r is proportional to a power of the carrying capacity K, namely $r = \alpha K^{\lambda}$ for $\alpha > 0$ and $\lambda \in \mathbb{R}$. A well-established result is that for $\lambda = 1$, the average population always exceeds that of the non-diffusing case, whereas for $\lambda = 0$, spatial heterogeneity induces a population decline. This talk will cover the intermediate case $\lambda \in (0, 1)$, which exhibits a more complex dependence on dispersal: slow diffusion leads to population growth, while sufficiently fast dispersal causes a decline. We will also provide insights for the cases $\lambda < 0$ and $\lambda > 1$.