The University of Edinburgh - Friedrich Schiller University

# Population Dynamics Virtual Seminar


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## Geometry as a predictor for evolutionary dynamics of populations undergoing range expansions in fragmented environments


Evolution of populations expanding into fragmented environment is a complex process shaped by the interplay of local population dynamics, mutations, migration, and environmental heterogeneity. While simulations can predict the evolutionary fate of specific populations via parametrised models, the interaction of these processes typically exacerbates analytical solutions.

Summarising the results of different projects and collaborations, we show how in the case of a well-defined population front encountering a habitat that varies on sufficiently large spatial scales, geometrical arguments can be used to predict and understand the effect of fragmentation on evolutionary dynamics.

We firstly illustrate the effects of fragmentation on standing neutral variation. We highlight an additional layer of 'survival of the luckiest' – complementary to, yet qualitatively different from, founder effects occurring in the presence of 'spatial bottlenecks'.

Secondly, we demonstrate how the success of a mutant, whose ability to invade patches inaccessible to the wild type is balanced by lower front speed, depends on habitat structure. The mutant can take over the population even when these patches are surprisingly sparse, and this phenomenon can be predicted based on the geometry of patches and the front speed of both mutant and wild type alone.

Lastly, we provide an outlook on how, in the future, similar arguments may shed light on other evolutionary scenarios in fragmented environments.


**Suggested readings:** https://doi.org/10.1371/journal.pcbi.1004615, https://doi.org/10.1209/0295-5075/123/58005, https://doi.org/10.1098/rsif.2021.0579

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