Estimating resistance surfaces using gradient forest and allelic frequencies

Mathieu Vanhove[1] and Sophie Launey[1]

[1]INRAE, Institut Agro, IFREMER

January 16, 2023

Abstract

Understanding landscape connectivity has become a global priority for mitigating the impact of landscape fragmentation on biodiversity. Link-based methods traditionally rely on relating pairwise genetic distance between individuals or demes to their landscape distance (e.g., geographic distance, cost distance). In this study, we present an alternative to conventional statistical approaches to refine cost surfaces by adapting the Gradient Forest (GF) approach to produce a resistance surface. Used in community ecology, GF is an extension of random forest (RF), and has been implemented in genomic studies to model species genetic offset under future climatic scenarios. By design, this adapted method, resGF, has the ability to handle multiple environmental predicators and is not subjected to traditional assumptions of linear models such as independence, normality and linearity. Using genetic simulations, resGF performance was compared to other published methods. In univariate scenarios, resGF was able to distinguish the true surface contributing to genetic diversity among competing surfaces better than the compared methods. In multivariate scenarios, the GF approach performed similarly to the other RF-based approach using least-cost transect analysis (LCTA). Additionally, two worked examples are provided using two previously published datasets. This machine learning algorithm has the potential to improve our understanding of landscape connectivity and can inform long-term biodiversity conservation strategies.

Hosted file

`Vanhove_resGF_MER_v2.docx` available at https://authorea.com/users/485201/articles/619310-estimating-resistance-surfaces-using-gradient-forest-and-allelic-frequencies