Estimating resistance surface on multilayers landscapes using gradient forest and allelic frequencies

Mathieu Vanhove[1] and Sophie Launey[1]

[1]INRAE, Institut Agro, IFREMER

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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 based on multiple environmental variables. Used in community ecology, Gradient Forest 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 predictors and is not subjected to traditional assumptions of linear models such as independence, normality and linearity. Using genetic simulations, our RF-based approach was compared to other published methods using univariate and multivariate scenarios. Additionally, two worked examples are provided using two previously published datasets. This machine learning algorithm has the potential improve our understanding of landscape connectivity and can inform long-term biodiversity conservation strategies.

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