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# Spatio-temporal graphs to assess connectivity in dynamic landscapes

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## Abstract

Conservation planning increasingly relies on the design of ecological networks to ensure functional connectivity between suitable habitat patches. A number of methods and indices have been proposed to quantify, analyze and optimize the connectivity of such spatial networks. These approaches generally consider landscapes to be static entities. In contrast, real landscapes are dynamic due to disturbance, ecological successions, agricultural and forest management, seasonal variations, urbanization and more generally global changes. Despite a wealth of studies on the significant impact of landscape dynamics on ecological communities, there has been no attempt at conceiving connectivity indices related to landscape spatio-temporal dynamics. We here illustrate with a metapopulation model in a dynamic landscape why static connectivity indices may fail at capturing key properties of dynamic landscapes, even when the temporal trajectories of such static indices are considered. We then explain how current connectivity indices could be reframed in a dynamic setting and use the concept of spatio-temporal graphs to represent landscape dynamics. We finally apply this concept of spatio-temporal graphs on a temporal series of forest maps, showing how it reveals new landscape features that are due to landscape dynamics.

**Keywords:** Connectivity, dynamic landscape, graph theory.

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