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Review article

Connectome: Graph theory application in functional brain network architecture

Fabrizio Vecchio [a,*], Francesca Mira

[a] Brain Connectivity Laboratory, IRCCS San Raffaele Pisana,

[b] Institute of Neurology, Dept. Geriatrics, Neuroscience & O

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EMPHASIZING NEW IDEAS TO STIMULATE RESEARCH IN ECOLOGY

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LANDSCAPE CONNECTIVITY: A GRAPH-THEORETIC PERSPECTIVE

DEAN URBAN[1,3] AND TIMOTHY KEITT[2,4]

[1]*Nicholas School of the Environment, Duke University, Durham, North Carolina 27708 USA*
[2]*National Center for Ecological Analysis and Synthesis, Santa Barbara, California 93101 USA*

Abstract. Ecologists are familiar with two data structures commonly used to represent landscapes. Vector-based maps delineate land cover types as polygons, while raster lattices represent the landscape as a grid. Here we adopt a third lattice data structure, the graph. A graph represents a landscape as a set of *nodes* (e.g., habitat patches) connected to some degree by *edges* that join pairs of nodes functionally (e.g., via dispersal). Graph theory is well developed in other fields, including geography (transportation networks, routing applications, siting problems) and computer science (circuitry and network optimization). We present an overview of basic elements of graph theory as it might be applied to issues of connectivity in heterogeneous landscapes, focusing especially on applications of metapopulation theory in conservation biology. We develop a general set of analyses using a hypothetical landscape mosaic of habitat patches in a nonhabitat matrix. Our results suggest that a simple graph construct, the minimum spanning tree, can serve as a powerful guide to decisions about the relative importance of individual patches to overall landscape connectivity. We then apply this approach to an actual conservation scenario involving the threatened Mexican Spotted Owl (*Strix occidentalis lucida*). Simulations with an incidence-function metapopulation model suggest that population persistence can be maintained despite substantial losses of habitat area, so long as the minimum spanning tree is protected.