For Symposium 5: Connectivity in human-dominated landscapes

Using Circuitscape to analyse landscape connectivity and guide restoration activities in SE Australia.

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Abstract

Habitat loss and fragmentation have resulted in the decline of biodiversity worldwide, where remaining wildlife populations are threatened by isolation, and the modifying effects of human use of landscapes. Global climate change is predicted to interact with these impacts and further challenge species as they are forced to locally adapt or shift their habitat ranges. It is widely recognized that species ranges will need to shift with future shifts in climate zones, and this requires landscapes that are 'connected' allowing movements to occur. To ensure species can continue to move in landscapes and maintain healthy populations, regional and continental scale connectivity conservation initiatives have commenced worldwide as a key management response, focusing on maintaining and restoring key linkages in landscapes (Crooks & Sanjayan 2006).

Circuitscape uses a circuit theory approach to identify multiple pathways from multiple points, by running current through a resistance layer to provide an accurate, quantitative assessment of landscape connectivity. Using circuit flow principles, current is able to flow through all possible paths, but will follow the least resistive path. Unlike other least-cost models, the output will show dispersal patterns in multiple directions and of varying strengths due to the influence of the resistance layer (McRae et al. 2008). As a result, proponents suggest that the output more accurately reflects the dispersal patterns of an organism.

The 'Slopes to Summit' (S2S) Initiative is a collaborative project (part of the "Great Eastern Range's continental connectivity initiative) to carry out restoration actions to strengthen landscape connectivity in the Holbrook region, south-eastern Australia (GER 2017). Much of the region is heavily cleared and fragmented, where isolated patches of remnant vegetation exist primarily along roadsides, water-courses, and farms. Remnant native vegetation provides refuge for a range of threatened and endangered species such as woodland birds. As part of a major project aimed at enhancing landscape connectivity in the region, connectivity analyses were performed using Circuitscape. The objectives of this analysis were to identify major corridors in the landscape, help prioritise and validate on-ground actions, and assist with evaluating the success of the project.

This paper will discuss the application of this program in the Holbrook region, and contribution to local connectivity conservation planning. One of the key features of this approach is in providing a decision support tool, where land managers can run scenarios to identify the best on-ground options to achieve maximum connectivity gains. The application of circuit theory in this manner allows land managers and researchers to more readily assess and quantify habitat connectivity in a wide variety of environments.

References:

Crooks KR, Sanjayan M (Eds.) (2006) Connectivity Conservation. Cambridge University Press, Cambridge UK.

Great Eastern Ranges (GER) (2017) Slopes to Summit. Accessed 01/03/2017. http://www.greateasternranges.org.au/our-partners/ger-regional-partnerships/slopes-to-summit/

McRae BH, Dickson BG, Keitt TH, Shah VB (2008) Using circuit theory to model connectivity in ecology, evolution and conservation. Ecology 89(10): 2712–24.