The effect of landscape structure & fragmentation on the distribution of the White-footed mouse (*Peromyscus leucopus*) in Montérégie, Québec.

Robby R. Marrotte[a,b,*], Virginie Millien[a] and Andrew Gonzalez[b]

[a]Redpath Museum, McGill University & [b]Department of Biology, McGill University

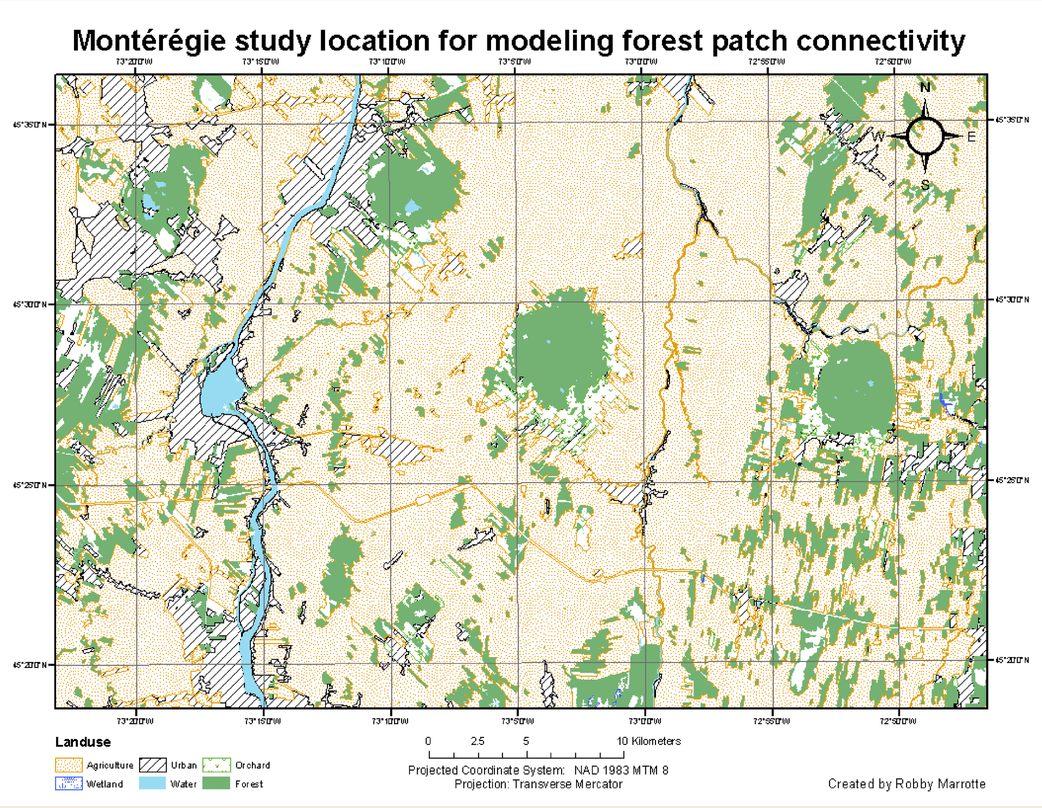
robby.marrotte@mail.mcgill.ca

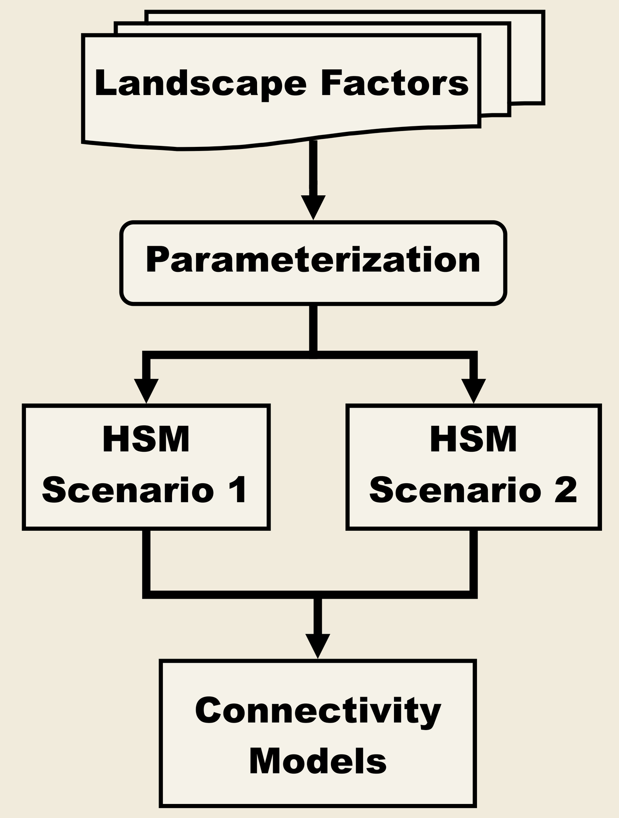
1. Context

The white-footed Mouse (*Peromyscus leucopus*) is currently at the Northern limit of its range in Québec. It is a key host for the black-legged tick (*Ixodes scapularis*) which carries and transmits Lyme disease, an emerging disease in Québec. This project aims to assess the effect of landscape fragmentation on the distribution of the white-footed mouse in the Monteregian area of Québec. From the literature, Habitat suitability models (HSM) were created. Because of opposing findings on whether the mouse is adapted or not to fragmentation two HSM models were created. The first scenario assumes that the mouse has not adapted to fragmentation and the second the mouse has adapted. Connectivity was analyzed for both scenarios with the Connectivity Analysis Package (CAT) (Carroll et al. 2011).

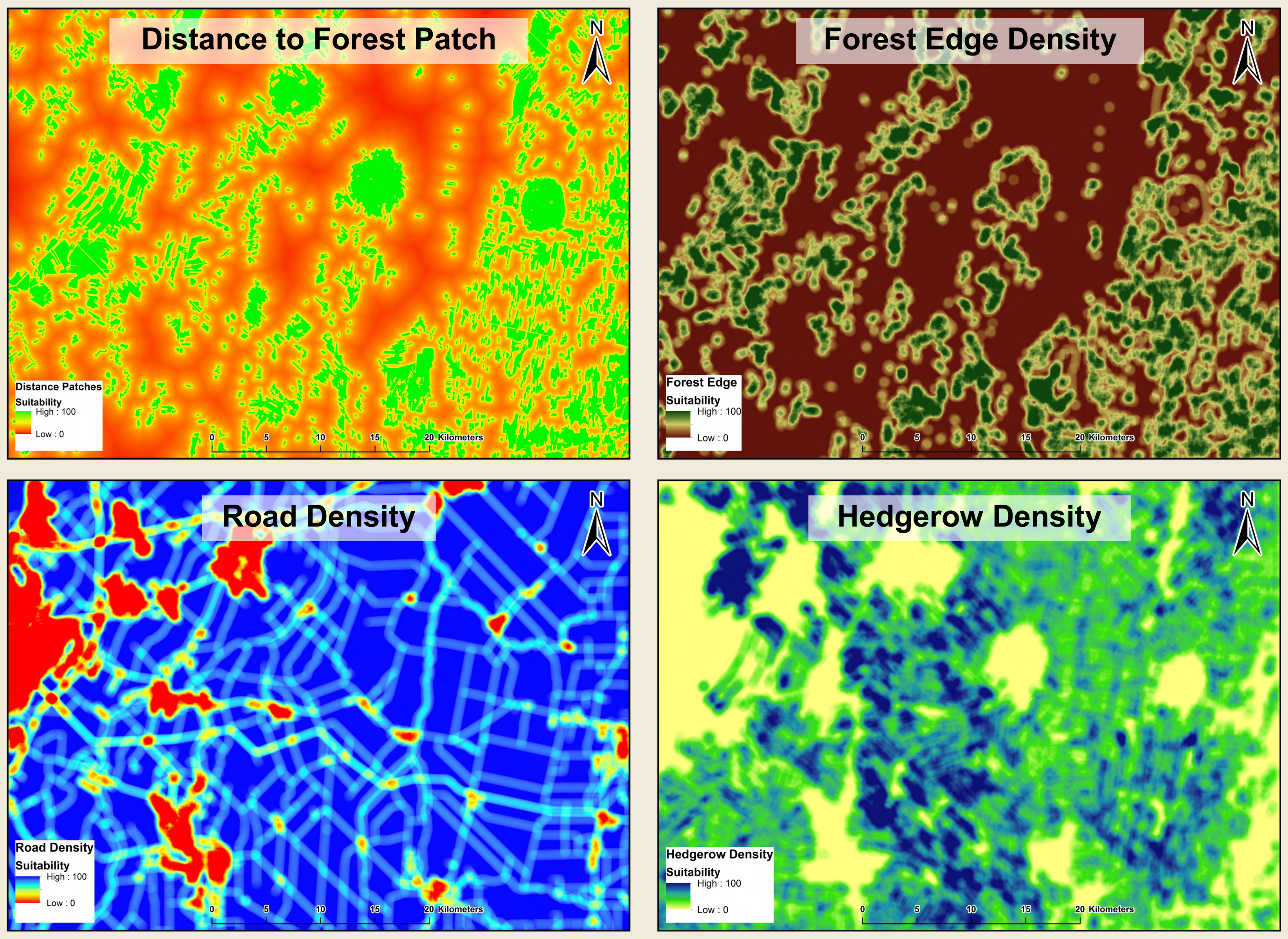
2. Methodology

The study site is bounded to the East by the much denser forest patch region of the Eastern Townships and to the West by the Richelieu River. Physical and ecological variables of *P. leucopus* were used to parameterize a HSM to predict the distribution of the mouse. The HSM was then used to model connectivity within the following extent of the Montérégie Landscape.





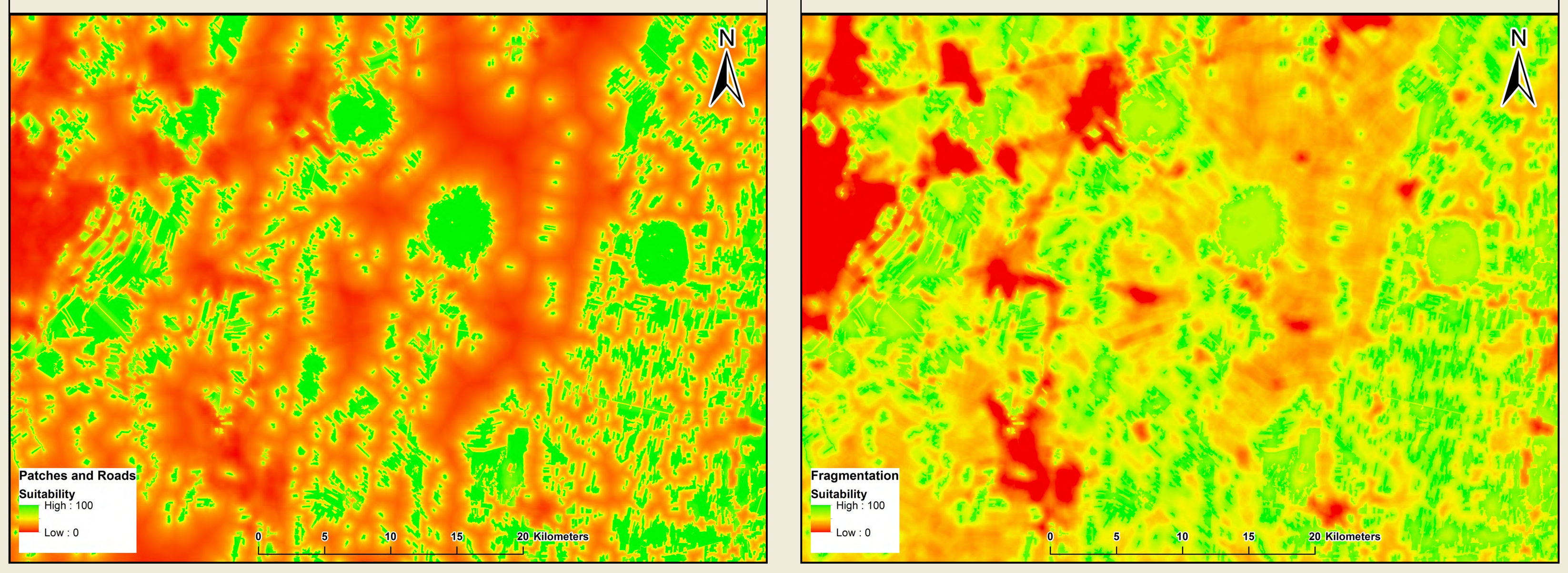
2.1 Landscape Factors



2.2 Habitat Suitability Models

Scenario 1: *P. leucopus* has not adapted to fragmentation

Scenario 2: *P. leucopus* has adapted to fragmentation



2.3 Mapping Connectivity

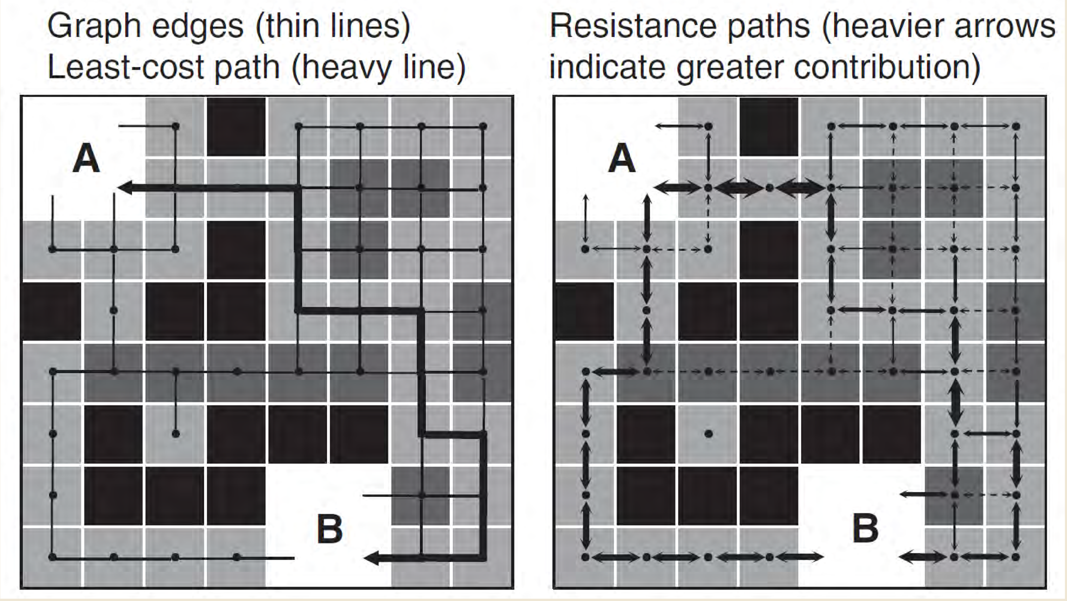
Shortest-path and Current flow Betweenness Centrality (BC) metrics (Newman 2010) were used to measure the role of nodes or pixel cells in mediating flow between all possible pairs of nodes within a network of graphs. These metrics aid in identifying 'gatekeeper' nodes or cells that have a relatively large role in facilitating movement across the network (Carroll et al. 2011).

Shortest-path or Least-cost path (LCP)

Maps the location of shortest paths between all combination of paired nodes in a network. The value assign to each node depicts the contribution of the node to all paired shortest paths.

Current flow

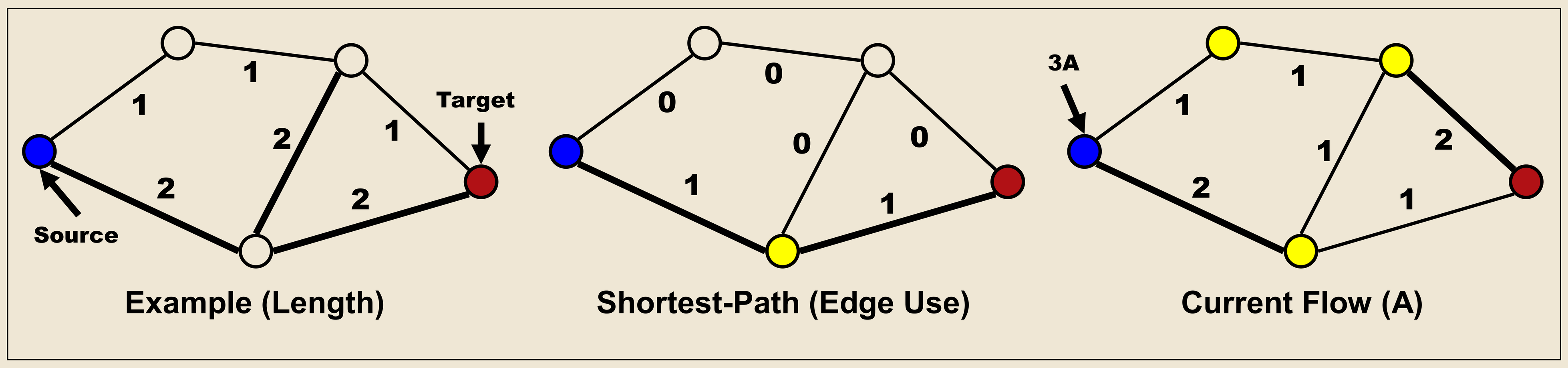
As demonstrated in McRae (2006), this metric treats the landscape as a circuit board, where networks of nodes are connected by resistors. Current is injected into a source node and allowed to flow across the network until it reaches the target node. The amount of current passed through each node reflects its contribution to the network.



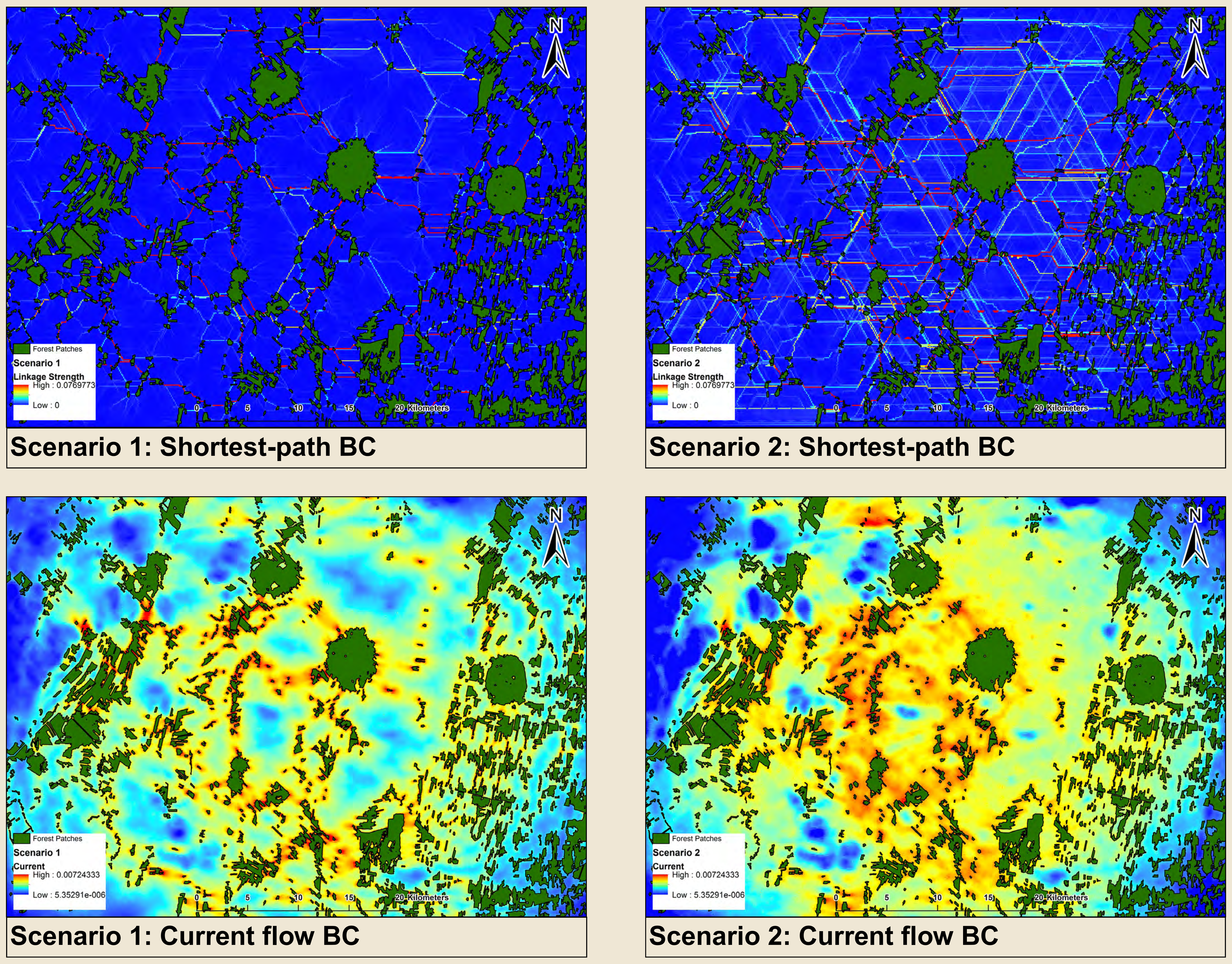
From Spear et al. (2010)

Contrasting these metrics

The major distinction between Shortest-path and Current flow is the ability of these metrics to identify pathways between paired nodes. Current flow identifies multiple pathways between nodes. Shortest-path only accounts for the most efficient least-cost path between nodes. Another distinction is that Shortest-path assumes that an individual has a broad perception of the landscape. Current flow is more of a probabilistic approach to identifying pathways between habitat patches, since pathways that aren`t cost efficient are still utilized.



3. Results



4. Outcome

This model will be useful for future work on connectivity between *P. leucopus* populations as it points out the most probable landscape pathways or corridors by which they are connected. Spatial data on the distribution of the white-footed mouse will be used to further adapt and validate the model. A better understanding of the mechanisms of dispersal of the white-footed mouse is essential if we are to anticipate the pattern of emergence of Lyme disease in Southern Québec.

5. References

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