Ranking Transportation Structures by their Potential to Facilitate Wildlife Passage

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Introduction

Wildlife movement is impeded by barriers in the landscape, including road infrastructure. We identified areas of the road network that are important for wildlife connectivity and assessed the relative value of transportation structures for wildlife passage. We developed a Terrestrial Organism Passage Screening Tool to rank 5,912 structures (>3ft diameter) by connectivity value for 8 mammal species. The Tool incorporates landcover, structure attributes, protected lands, and wildlife occupancy and expert opinion data to determine the overall connectivity value of each structure.

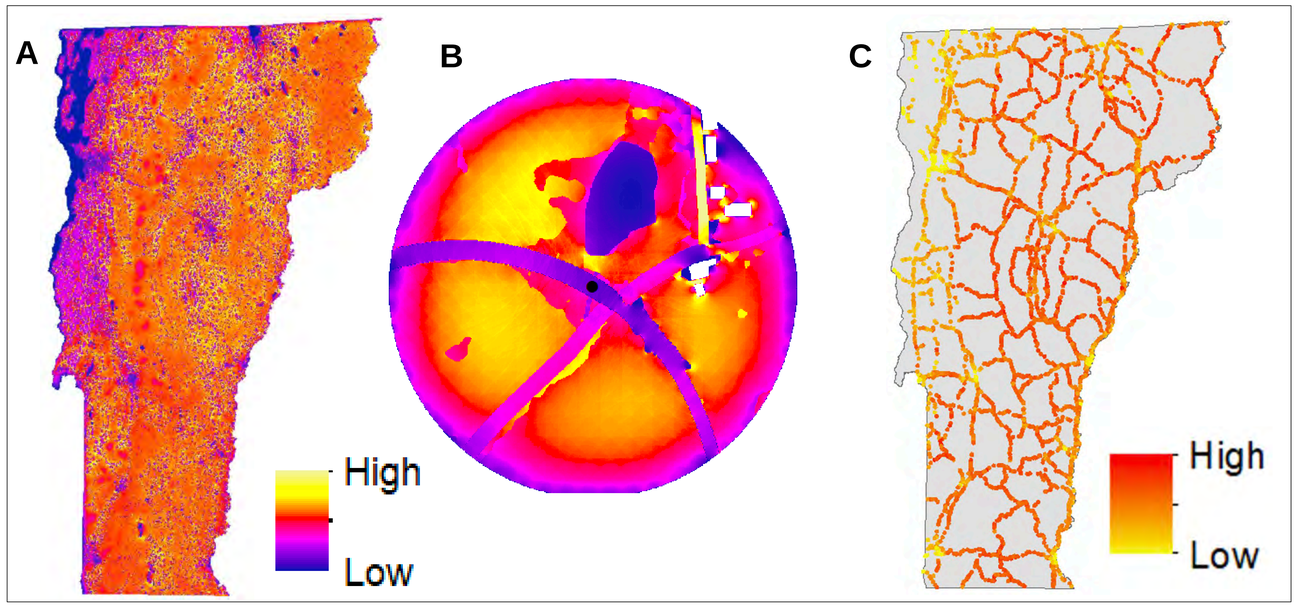

Figure 1. A) Depiction of predicted wildlife movement probability for 8 species at the landscape scale, estimated using circuit theory. B) An example of the structure scale analysis centered on one transportation structure. C) Preliminary ranking of structure connectivity value using landscape scale results for all species.

Objective I: Assess Connectivity Value of Structures

We evaluated structure connectivity value using electrical circuit theory, which treats the movement of animals as the flow of electricity through a circuit[1]. Circuit-based models of wildlife movement were created using the Omniscape program at two spatial scales for each species, incorporating wildlife occurrence and expert opinion data[2,3]. The landscape scale modeled wildlife movement throughout Vermont (Fig. 1A), and the structure scale modeled detailed movements around each individual structure (Fig. 1B). From an all-species combined model, we recorded the mean current density around each structure at the landscape scale (1km radius, Fig. 1C) and structure scale (50m radius) to incorporate into the Screening Tool rankings.

Objective II: Develop Screening Tool

We developed the Terrestrial Organism Passage Screening Tool: an Excel-based linear programming decision-making framework to rank structures for connectivity. The Tool incorporates multiple criteria to calculate overall connectivity rankings, including data from the circuit models, structure attributes, human development metrics, and protected lands. Data were normalized, and combined to generate a score and ranking for each structure. Criteria thresholds were also added to provide more ranking options and flexibility for VTrans managers.

Figure 2. Project partners checking wildlife cameras at transportation structures. Camera data collected through all phases of the project will be used to validate structure connectivity scores.

Conclusions

We generated models of wildlife movement throughout Vermont and around individual structures using a novel circuit theory approach. These data were combined with information on structure attributes, human development, and protected lands to generate a comprehensive ranking of overall connectivity value for 8 species. The Terrestrial Organism Passage Screening Tool rankings will help transportation managers evaluate the relative value of structures for wildlife and aid in environmental decision making.

Acknowledgments

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References

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