



Conservation, Connectivity, and Coexistence: Understanding Corridor Efficacy in Fragmented Landscapes

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Master of Science
University of North Texas

Research Overview

Background

Research Objectives

- 1) Minimize the subjectivity in the delineation process of patch-corridor-matrix boundaries
- 2) Identify ambiguous transitional areas of patch-corridor interfaces
- 3) Assess focal species responses to the heterogeneity of landscapes

Conclusions

Future Research

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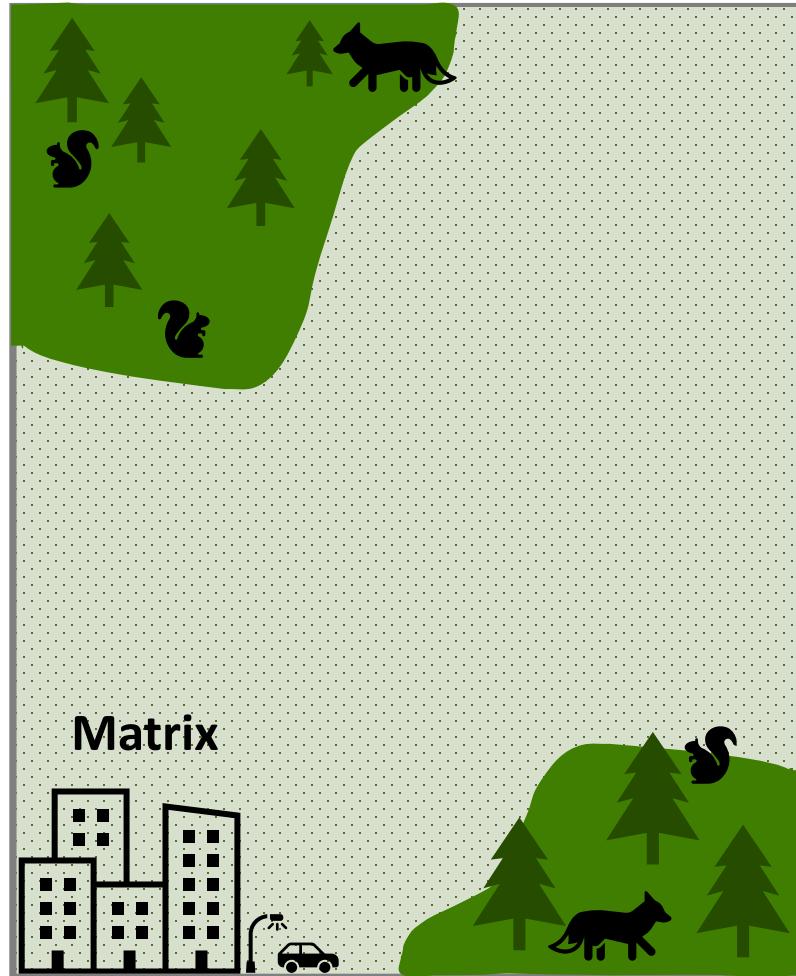
Conclusions

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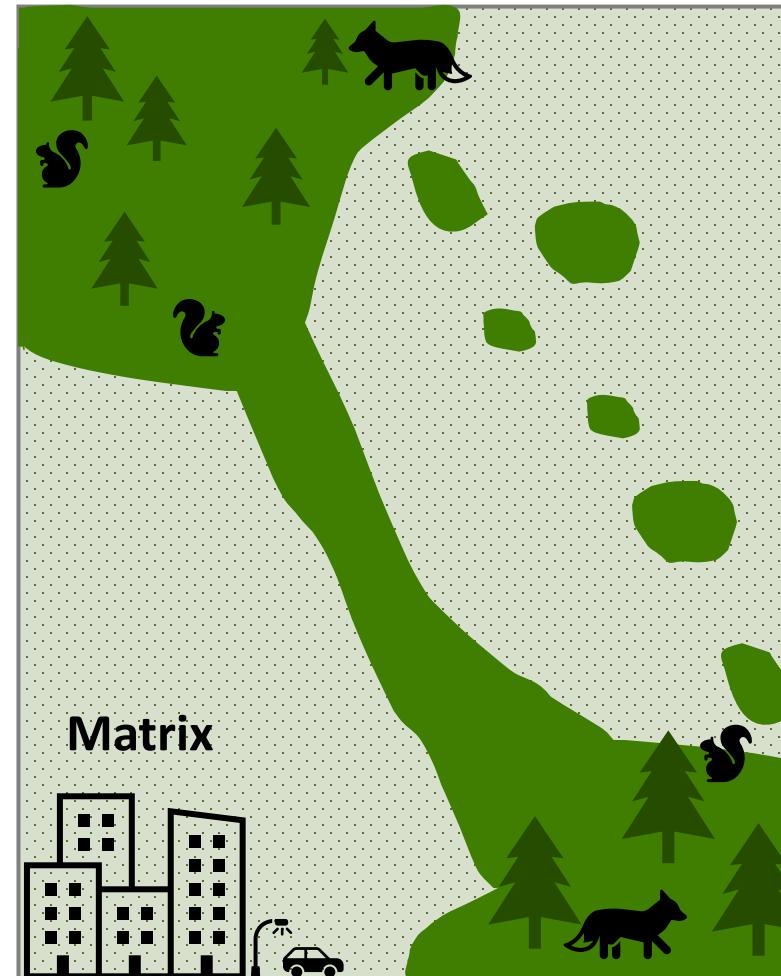
An aerial photograph of a rural landscape, likely farmland, characterized by a patchwork of various agricultural fields. The fields are of different sizes, shapes, and colors, ranging from deep green to brownish-tan, indicating different crops or stages of cultivation. Small clusters of buildings, possibly farmhouses or small towns, are scattered throughout the fields. The overall pattern is one of fragmentation, where large tracts of land have been divided into many smaller parcels. The image captures the intricate textures and patterns created by agricultural practices.

Landscape Fragmentation

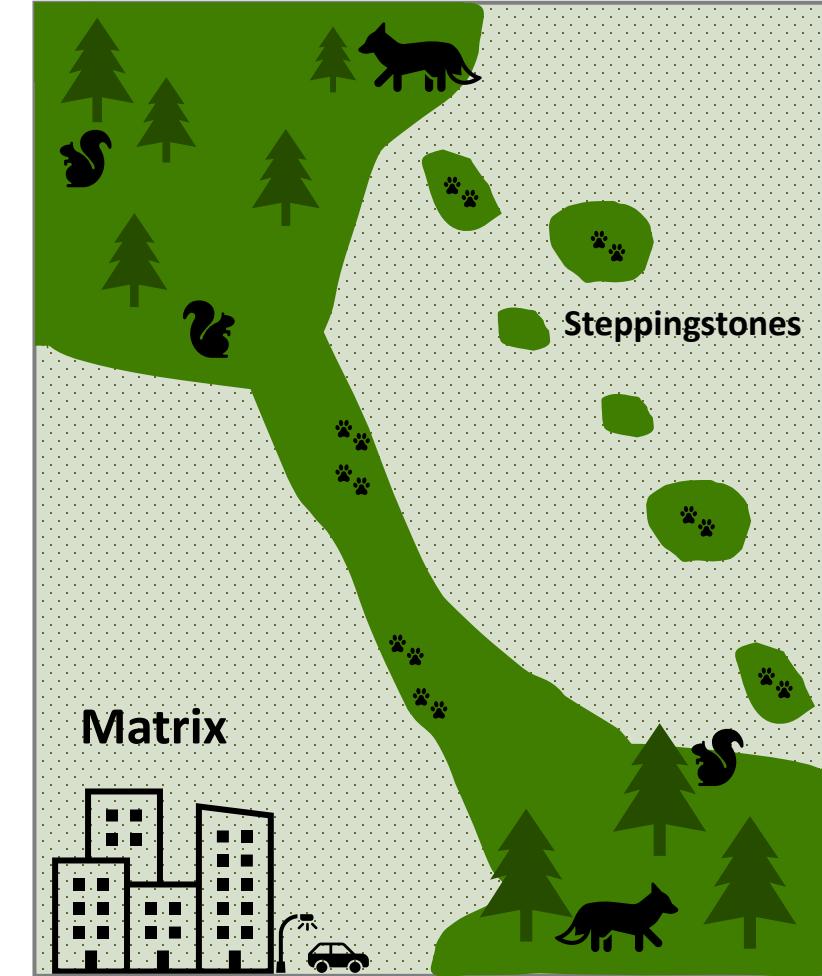
Landscape Connectivity



Fragmentation



Structural



Functional

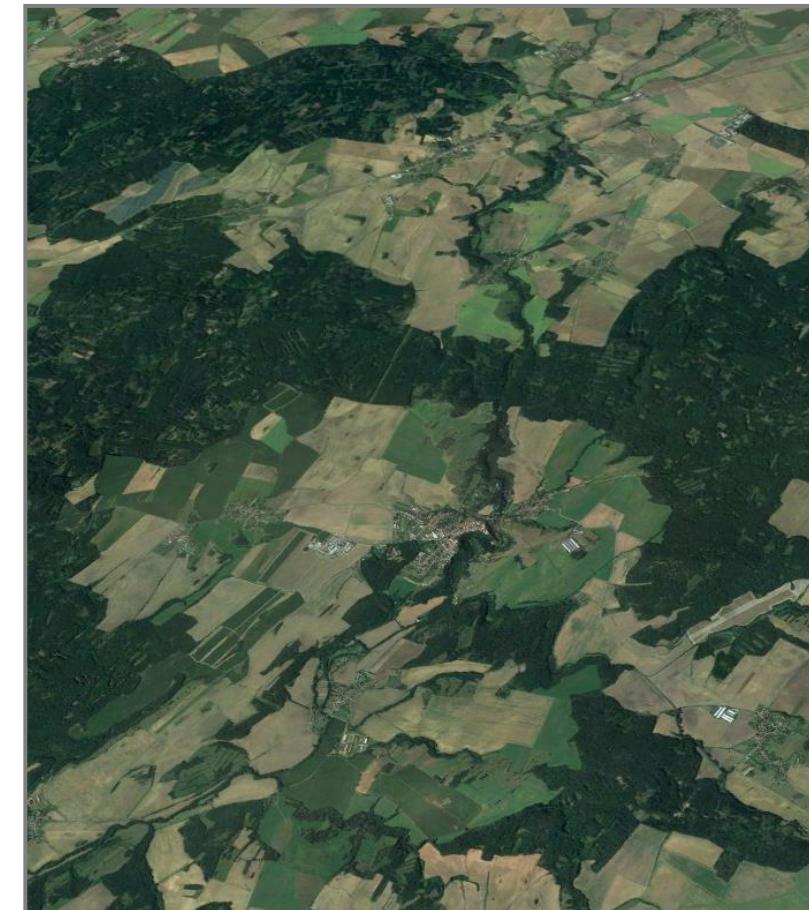
Conservation Corridors



Wildlife Crossing
Banff National Park



Experimental Corridor
Savannah River Site, SC



***De facto* Corridor**
Czechia

(Beier and Gregory 2012)

Do Corridors Work?

A Corridors Efficacy Study

Using *de facto* corridors to measure long-term gene flow

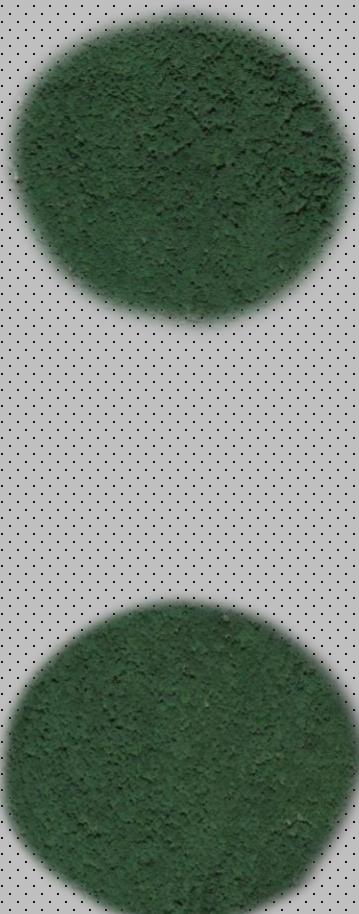
- Field sampling
- Genetic analysis
- Spatial modelling

(Beier and Gregory 2012; Do Corridors Work 2022)

Landscape Configuration



Corridor Complex



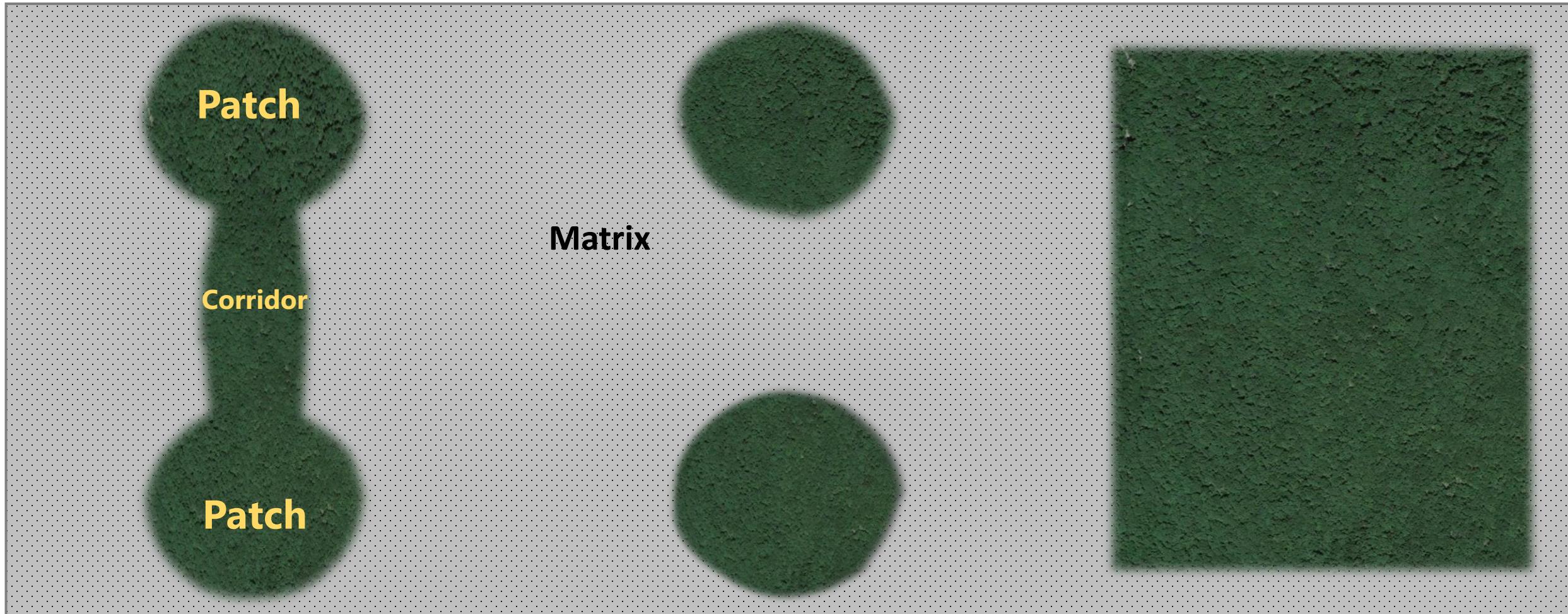
Isolates



Intact Reference

Matrix

Landscape Configuration



Corridor Complex
Patch-Corridor-Patch

Isolates

Intact Reference

Focal Species



Traverse a corridor in a discrete event

Passage Species



Use a corridor as habitat

Corridor Dweller

(Beier and Loe 1992)

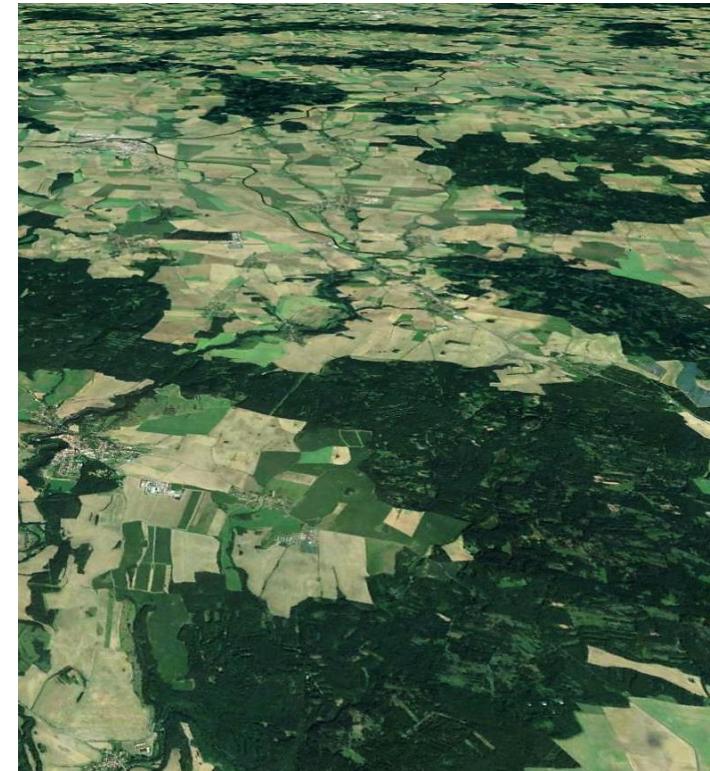
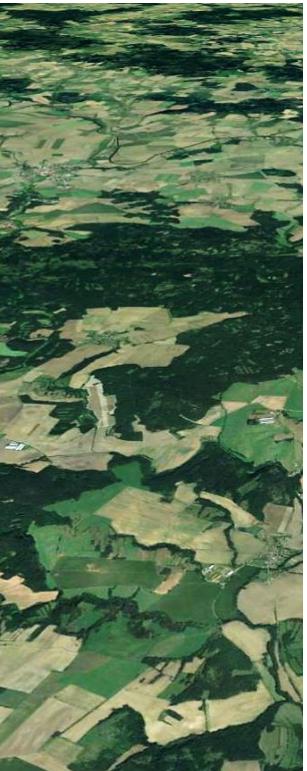
Research Purpose

Investigate the degree to which the presence of a corridor influences connectivity when compared to intact reference areas and isolates



Knowledge Gaps

- (1) Delineating boundaries of landscape elements
- (2) Identifying corridor termini
- (3) Understanding species responses to heterogeneity



Study Areas and Focal Species

Idaho

Western Harvest Mouse
(*Reithrodontomys megalotis*)



Kansas

White-footed Mouse
(*Peromyscus leucopus*)



Czechia

Yellow-necked Mouse
(*Apodemus flavicollis*)



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Conclusions

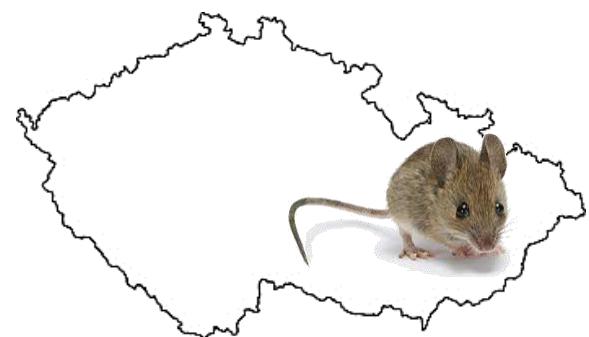
Future Research



Kansas
White-footed mouse
(*P. leucopus*)



Idaho
Western Harvest Mouse
(*R. megalotis*)



Czechia
Yellow-necked Mouse
(*A. flavicollis*)

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- 1) Minimize the subjectivity in the delineation process of patch-corridor-matrix boundaries
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- 3) Assess focal species responses to the heterogeneity of landscapes and quantify connectivity

Conclusions

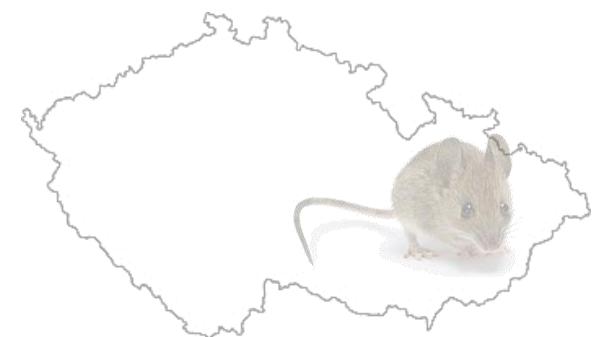
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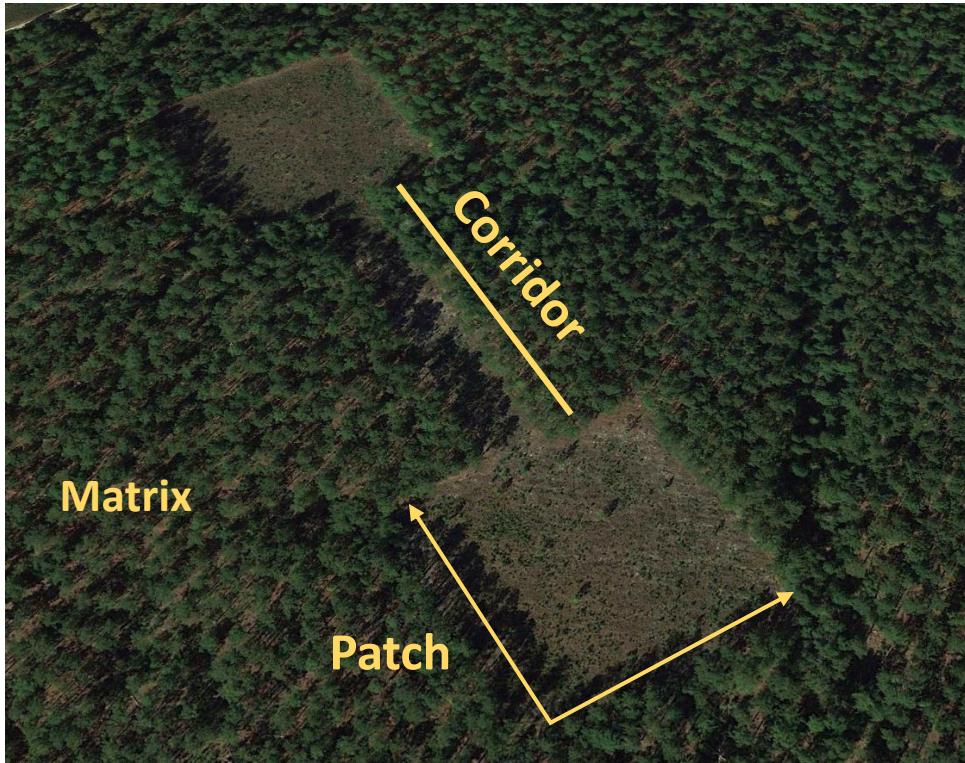


Czechia
Yellow-necked Mouse
(*A. flavicollis*)

Minimize the subjectivity in the delineation process of patch-corridor-matrix boundaries

Distinct boundaries

No tortuosity or pinch points



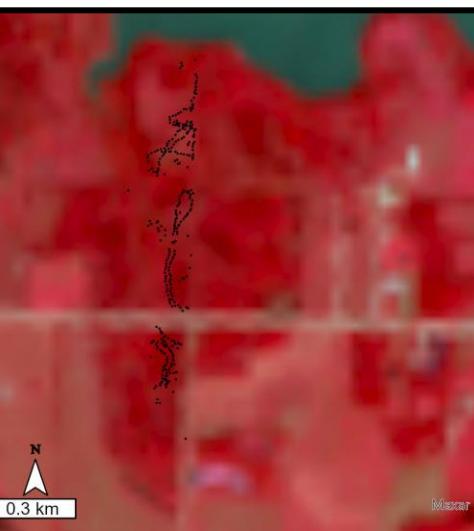
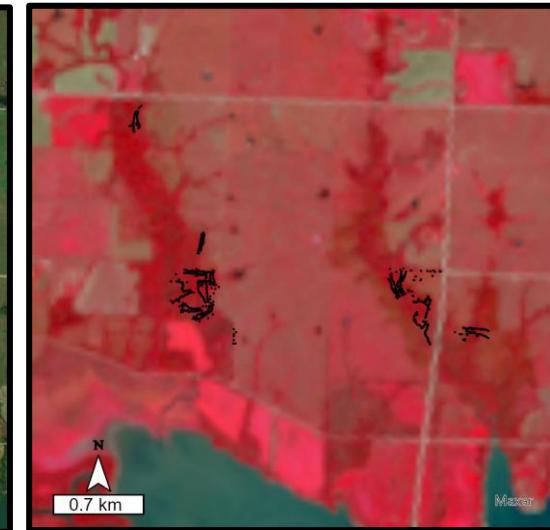
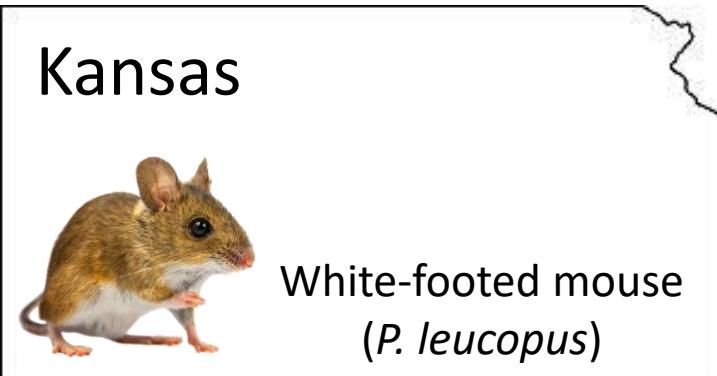
Experimental Corridor
Savannah River Site, SC

How do we define the boundaries?
Where does the patch end?



***De facto* Corridor Complex**
Kansas

1) Minimize the subjectivity in the delineation process of patch-corridor-matrix boundaries

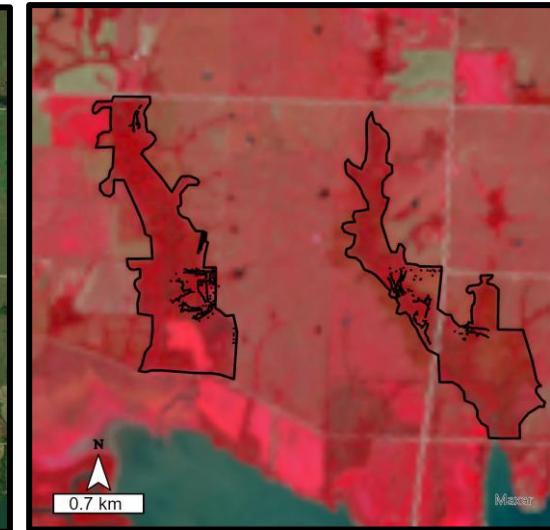
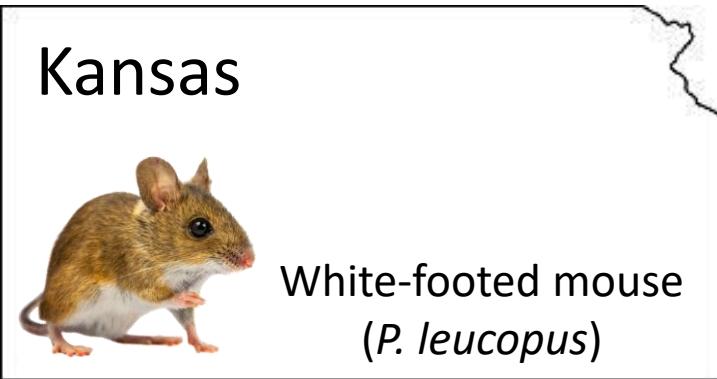


Isolates

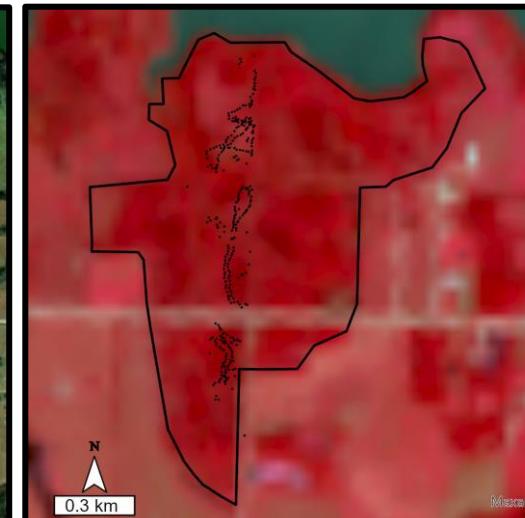
- Trap Locations
- Landsat 8 OLI/TIRS Level I
September 19, 2020
- Red: NearInfrared
 - Green: Red
 - Blue: Green

Reference

1) Minimize the subjectivity in the delineation process of patch-corridor-matrix boundaries



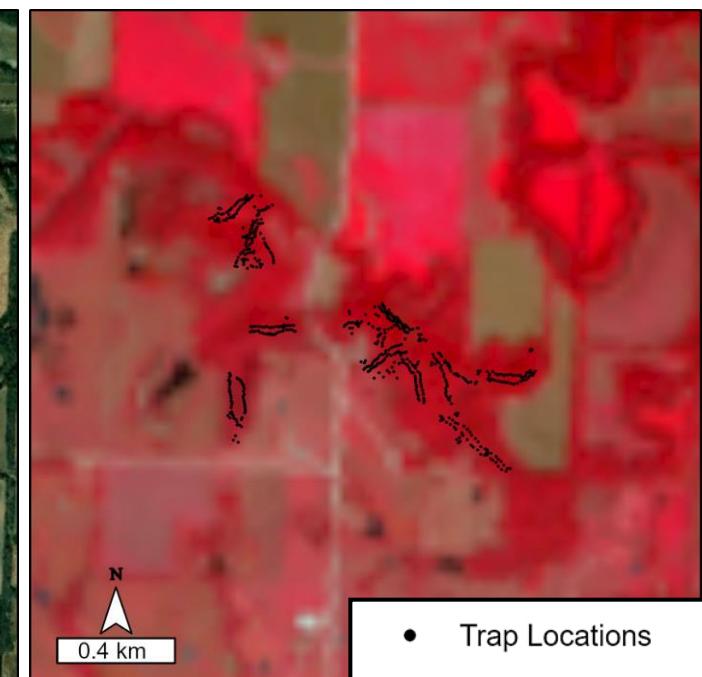
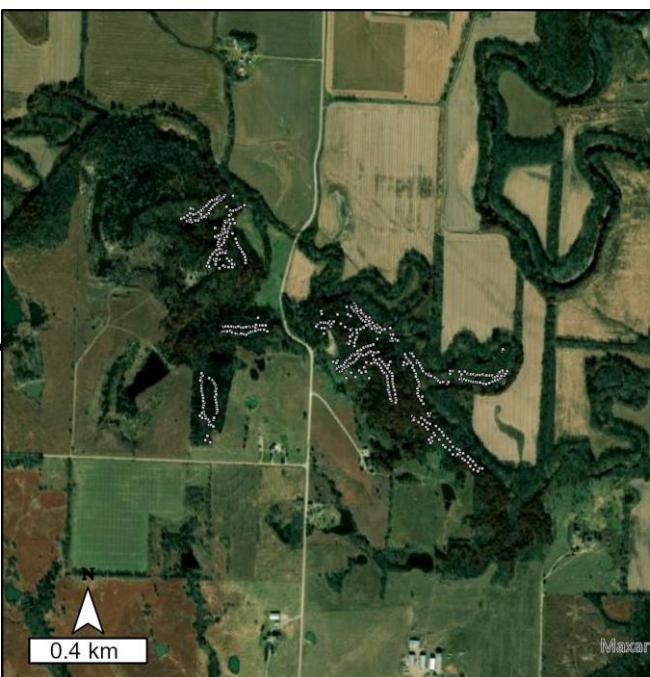
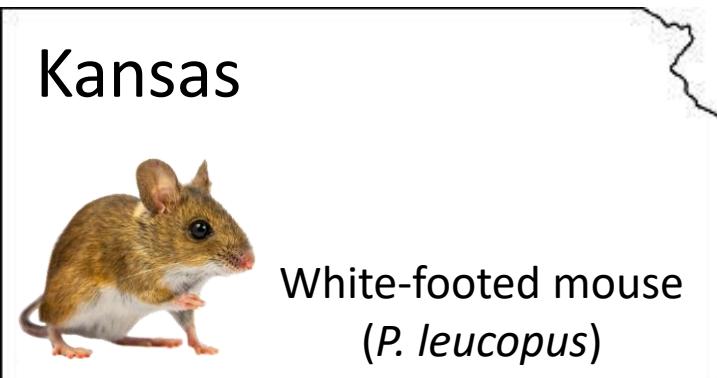
Isolates



- Trap Locations
 - Delineation
- Landsat 8 OLI/TIRS Level I
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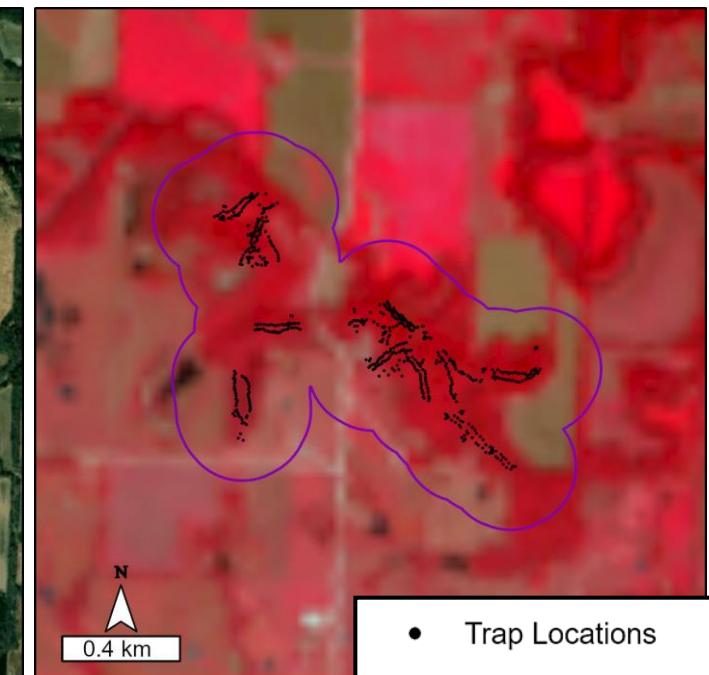
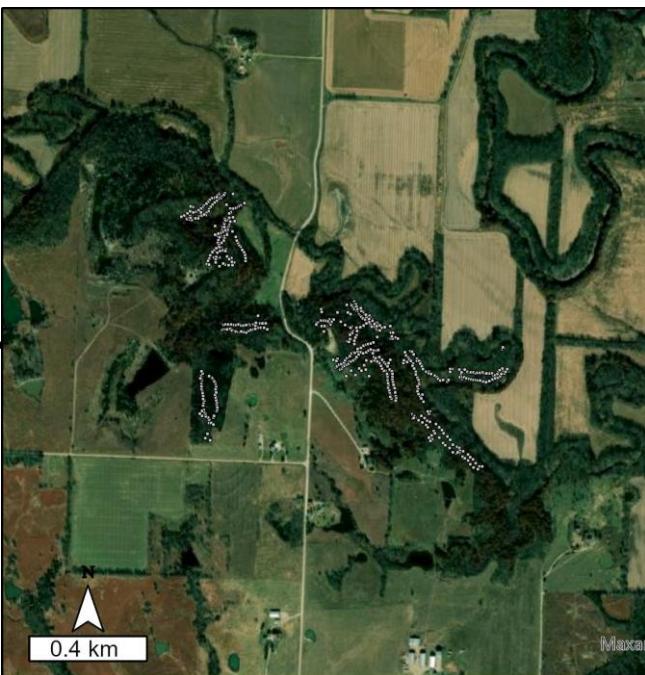
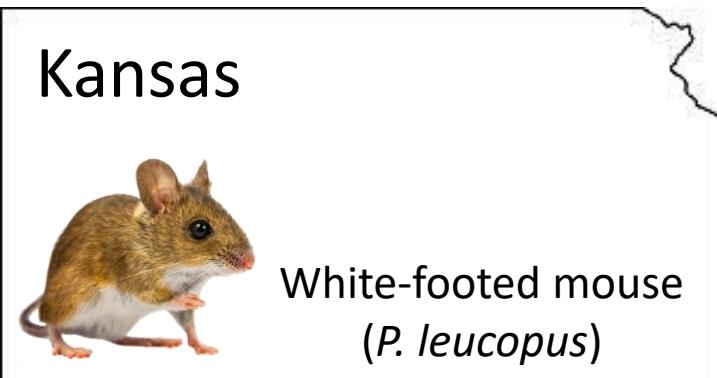
Corridor Complex

- Trap Locations

Landsat 8 OLI/TIRS Level I
September 19, 2020

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1) Minimize the subjectivity in the delineation process of patch-corridor-matrix boundaries



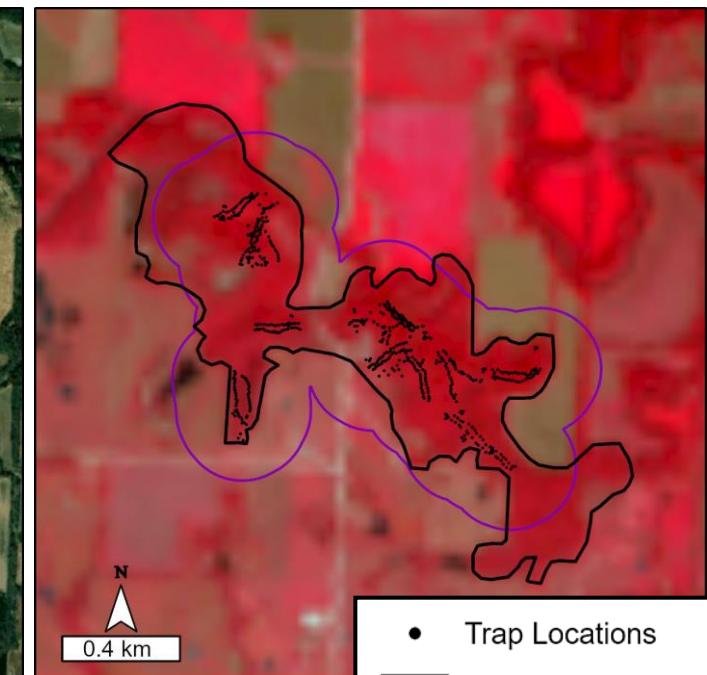
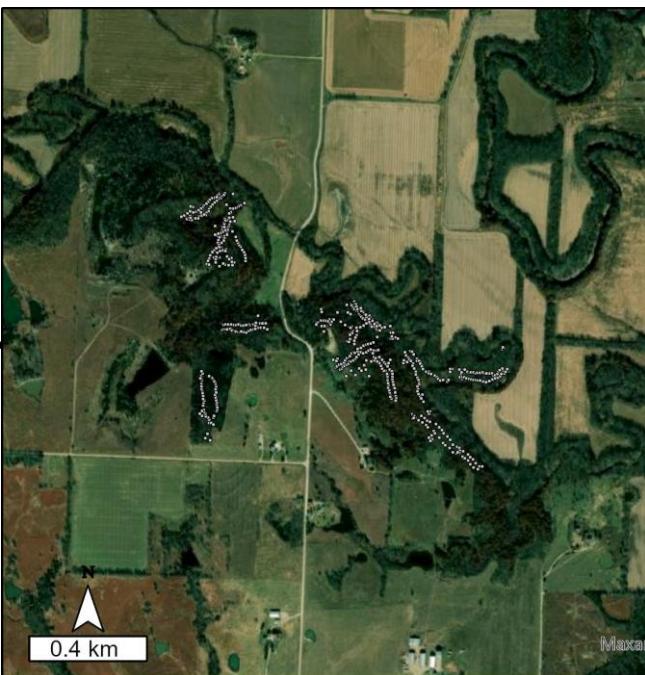
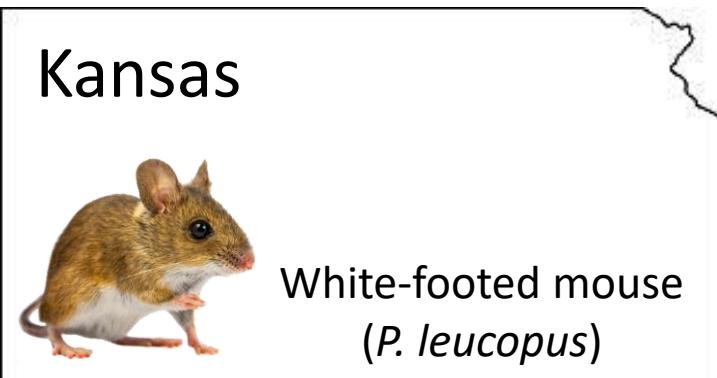
Corridor Complex

207 m

- Species perspective of landscape
- Literature lacks dispersal data
- Accounts for home range overlaps
 - Corridor dwellers reside, mate, reproduce
- Gives model room to run

- Trap Locations
- Home Range Buffer
- Landsat 8 OLI/TIRS Level I
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1) Minimize the subjectivity in the delineation process of patch-corridor-matrix boundaries



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●	Trap Locations
□	Delineation
■	Home Range Buffer
Landsat 8 OLI/TIRS Level I	
September 19, 2020	
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Kansas
White-footed mouse
(*P. leucopus*)



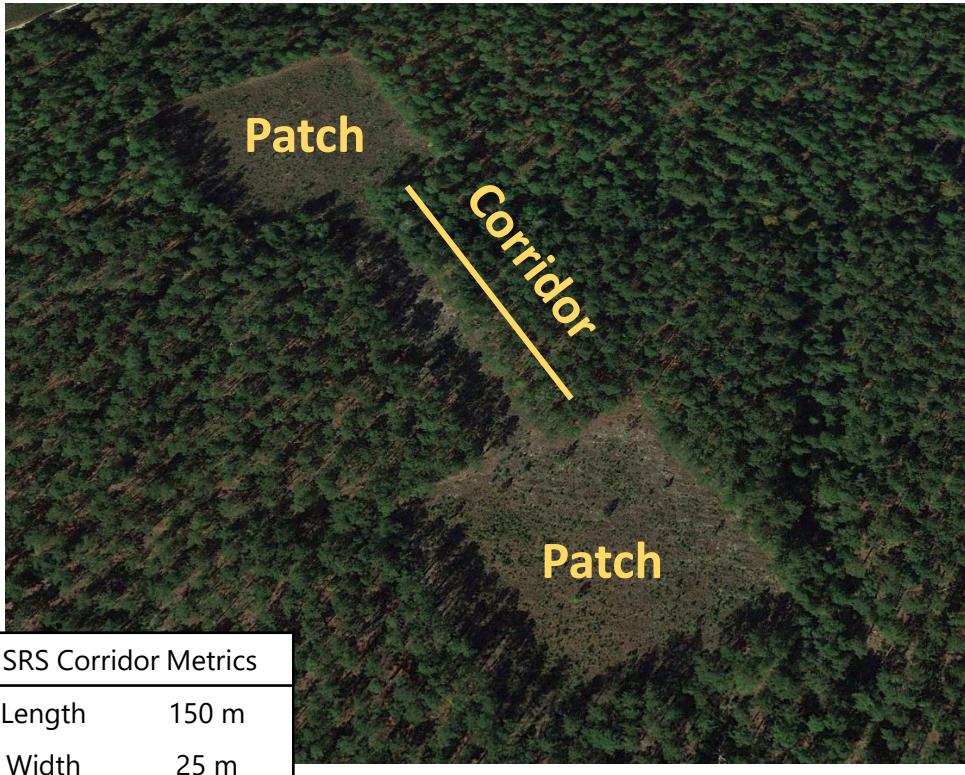
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Western Harvest Mouse
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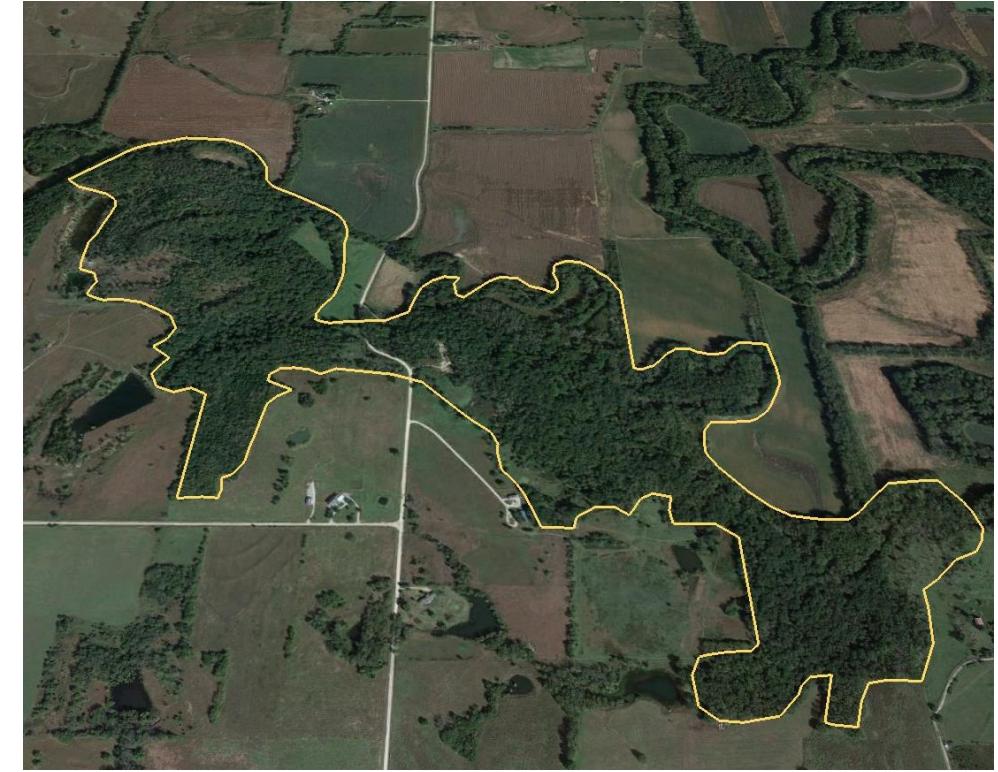
Identify ambiguous transitional areas of patch-corridor interfaces

Unambiguous transitions
No tortuosity or pinch points



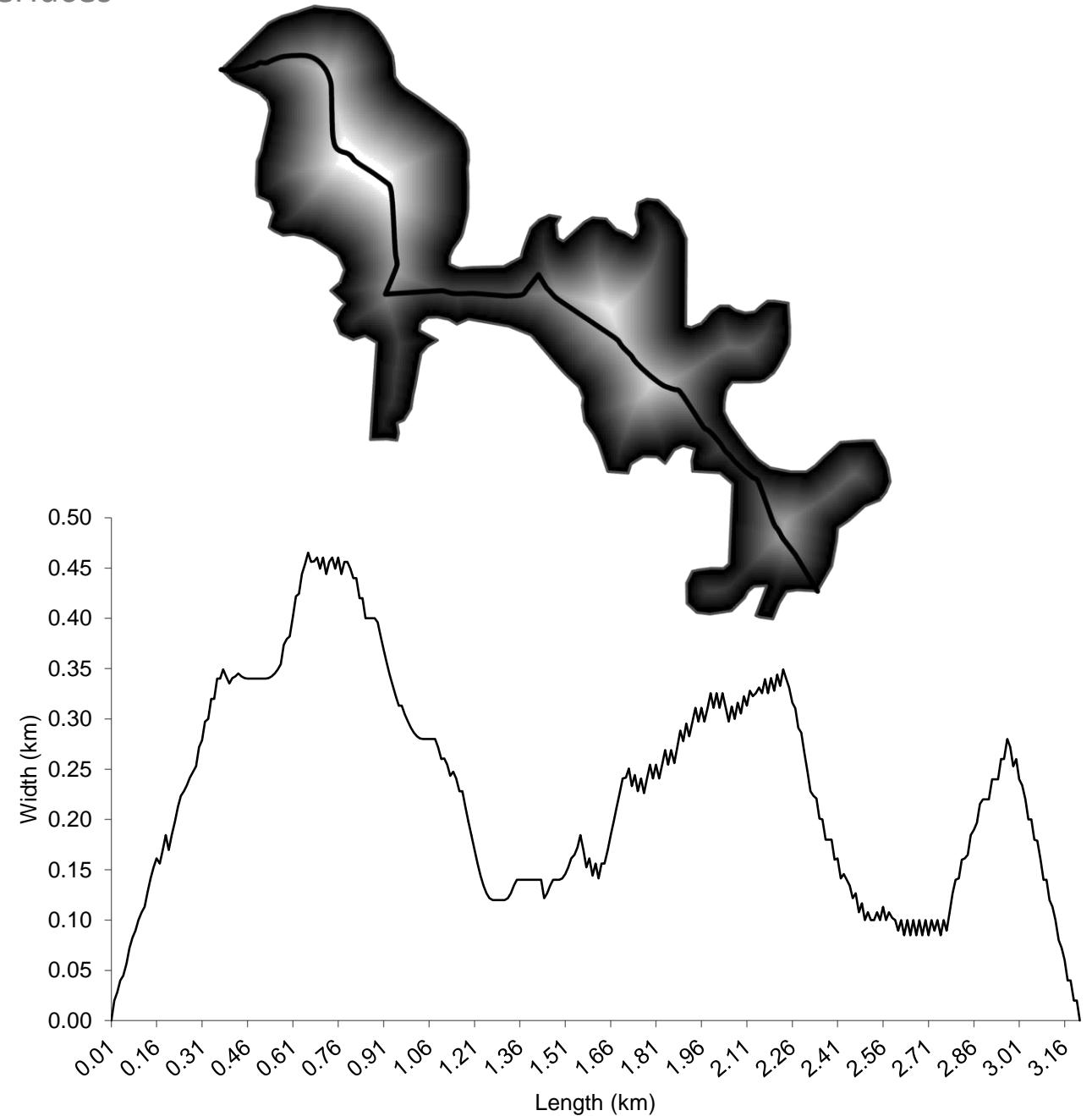
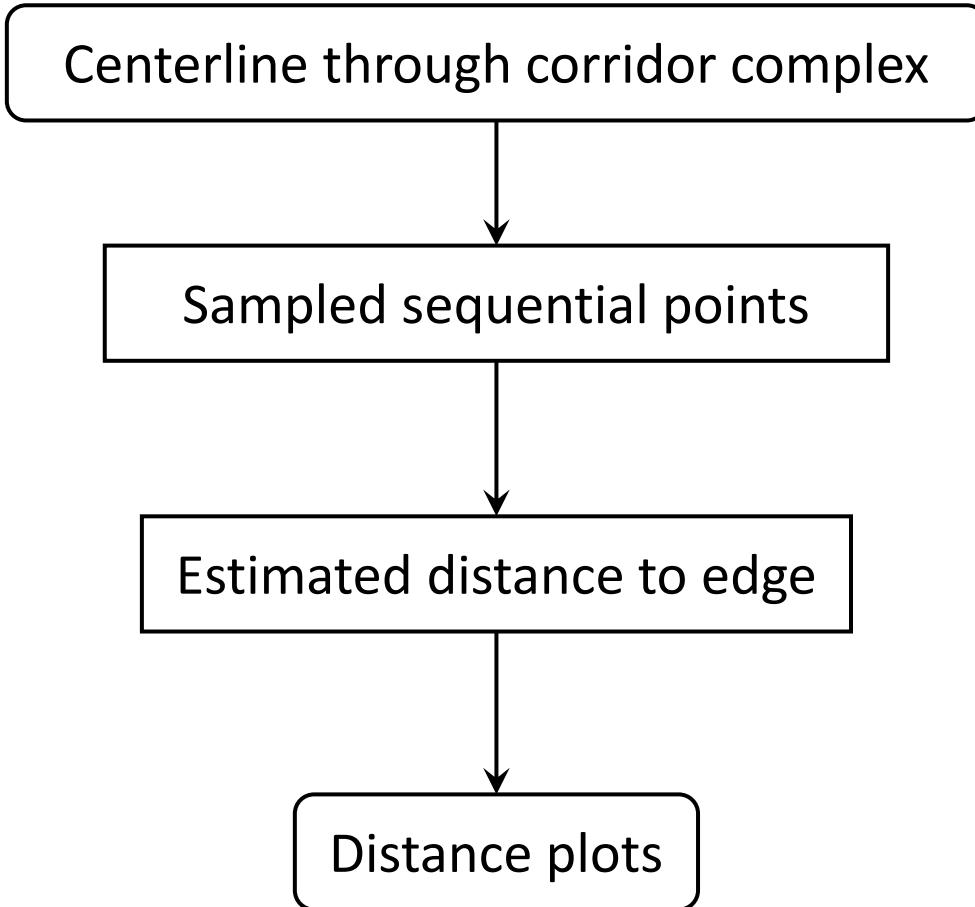
Experimental Corridor
Savannah River Site, SC

Where does the corridor start and end?

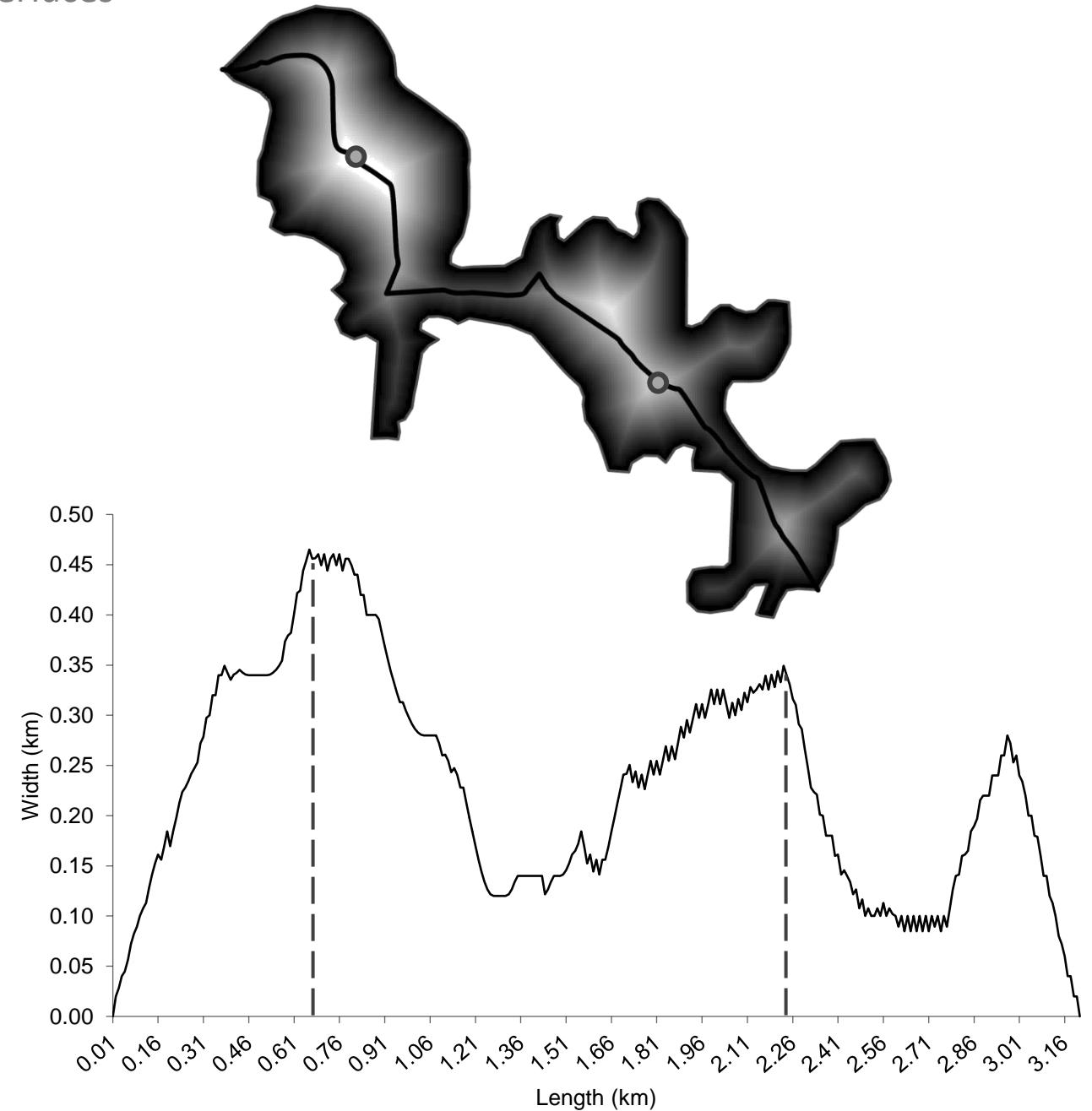
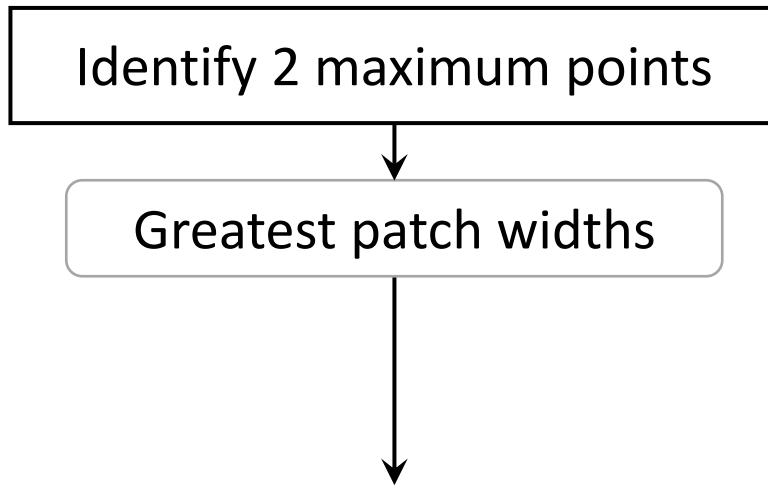


***De facto* Corridor Complex**
Kansas

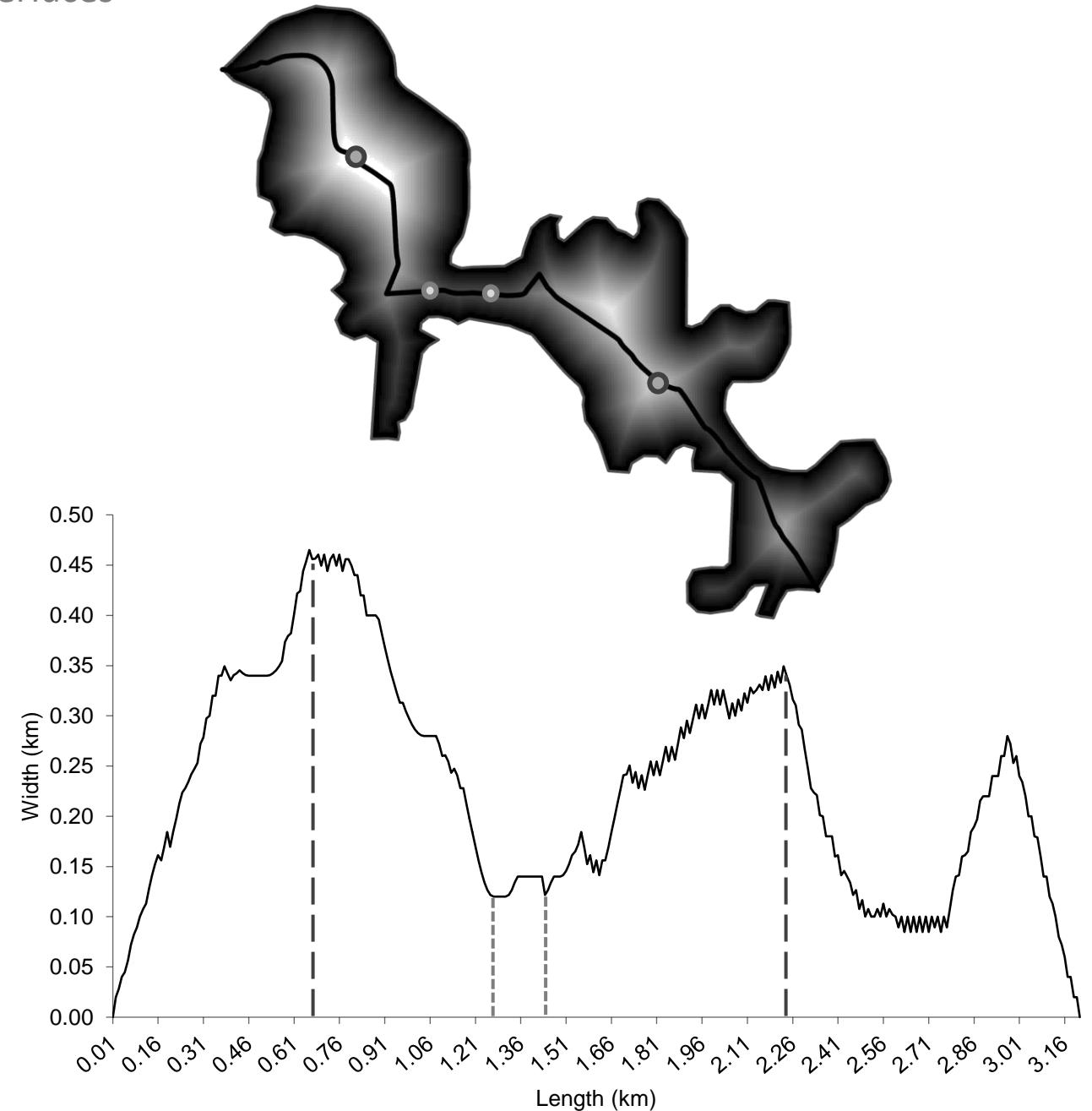
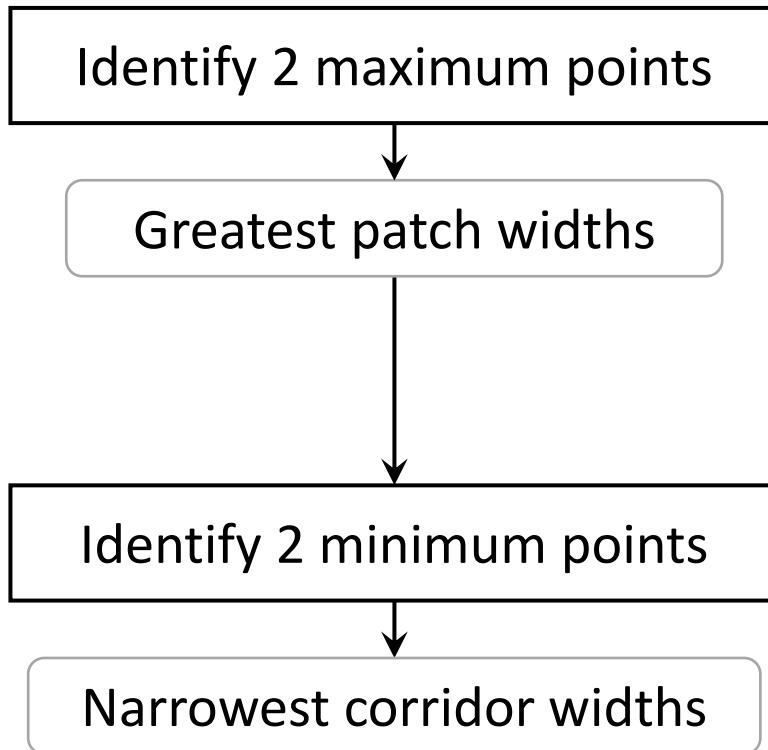
2) Identify ambiguous transitional areas of patch-corridor interfaces



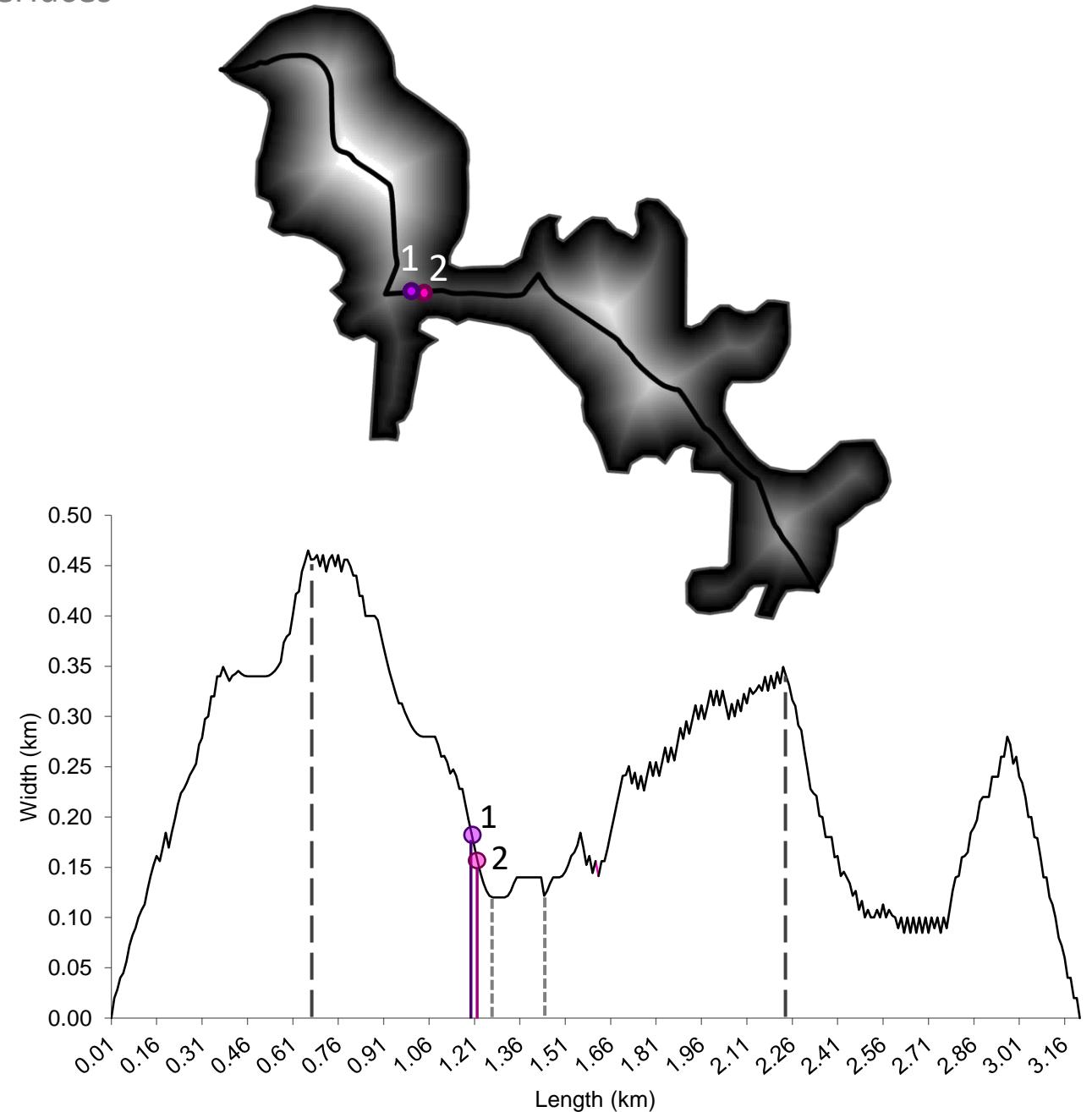
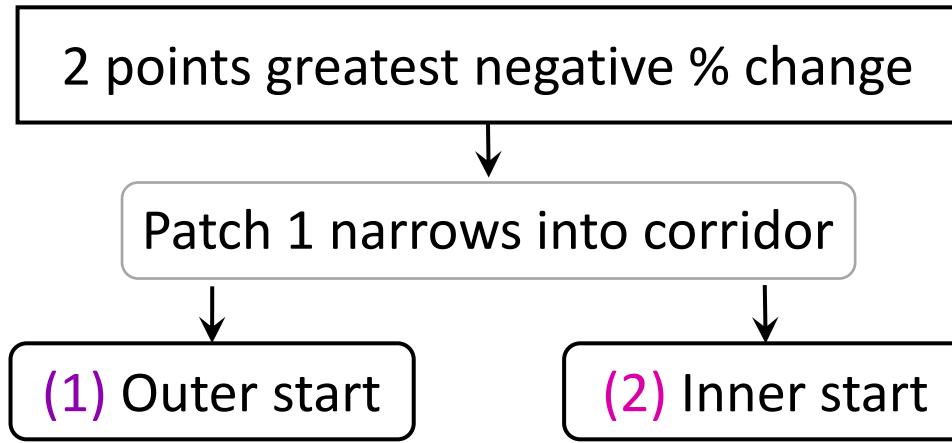
2) Identify ambiguous transitional areas of patch-corridor interfaces



2) Identify ambiguous transitional areas of patch-corridor interfaces



2) Identify ambiguous transitional areas of patch-corridor interfaces



2) Identify ambiguous transitional areas of patch-corridor interfaces

2 points greatest negative % change

Patch 1 narrows into corridor

(1) Outer start

(2) Inner start

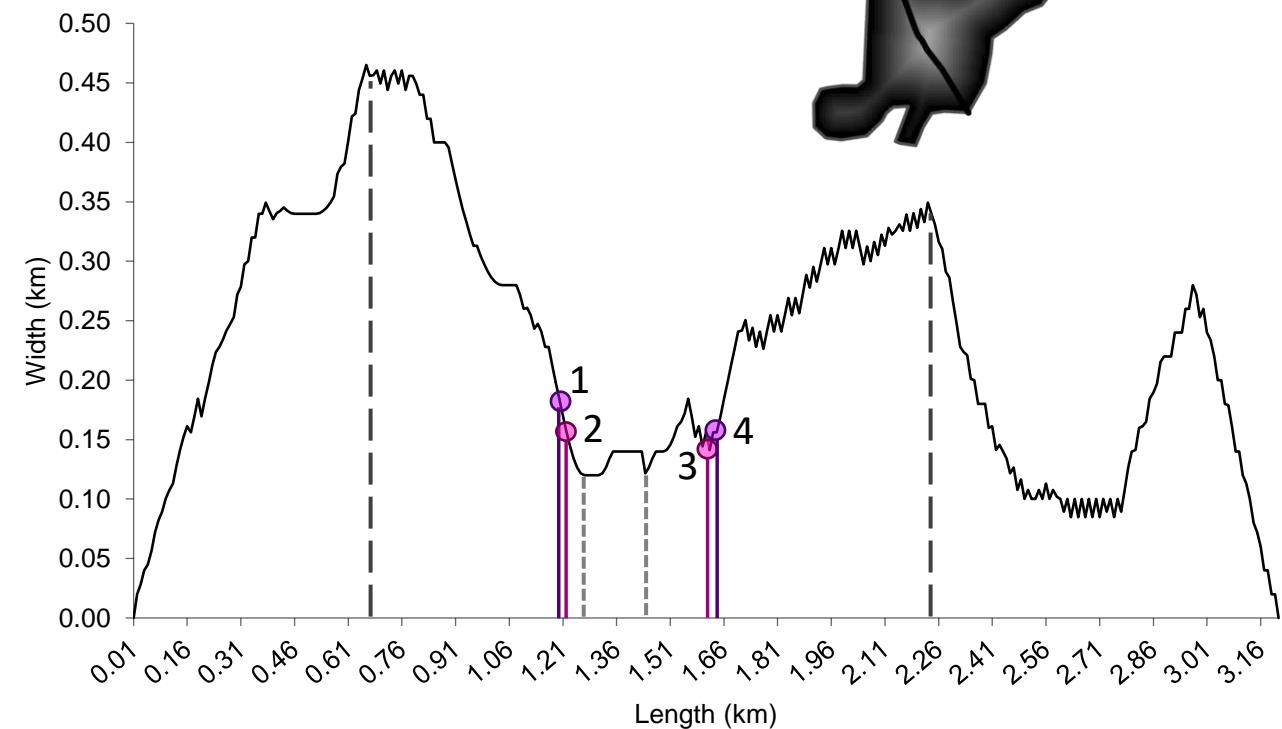
2 points greatest positive % change

Corridor widens into patch 2

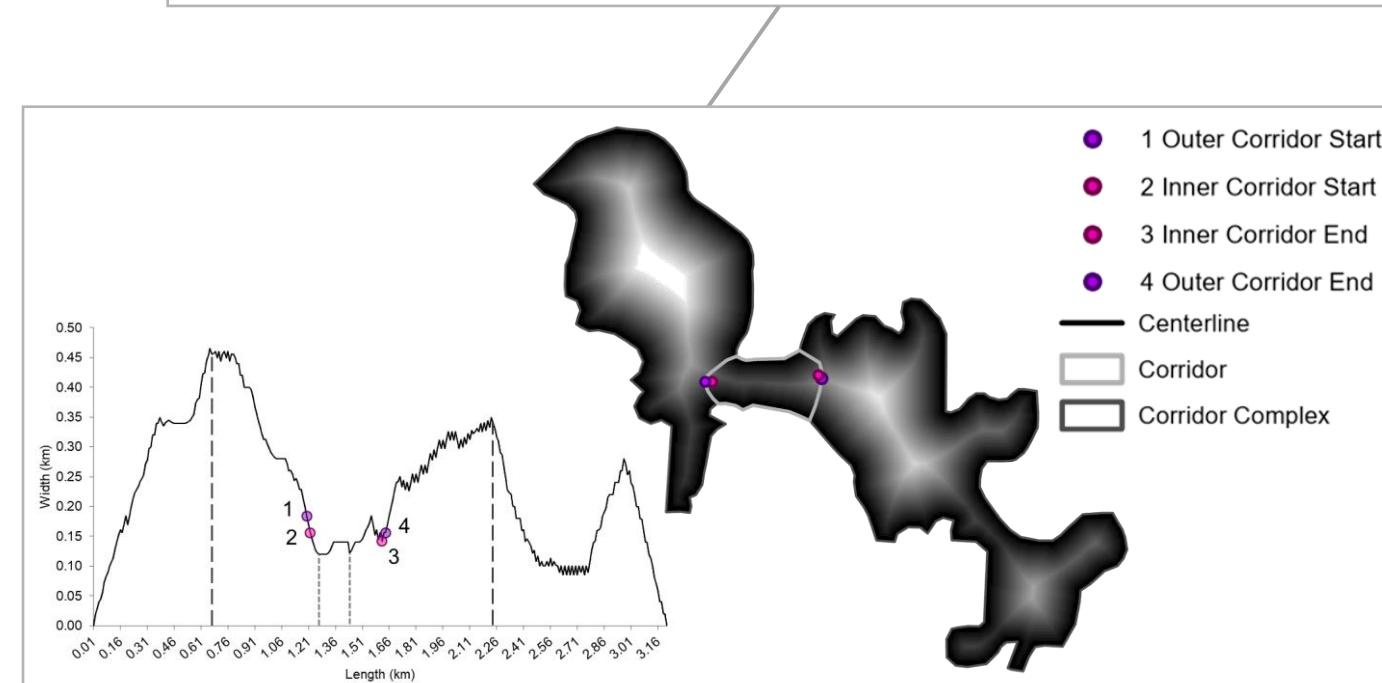
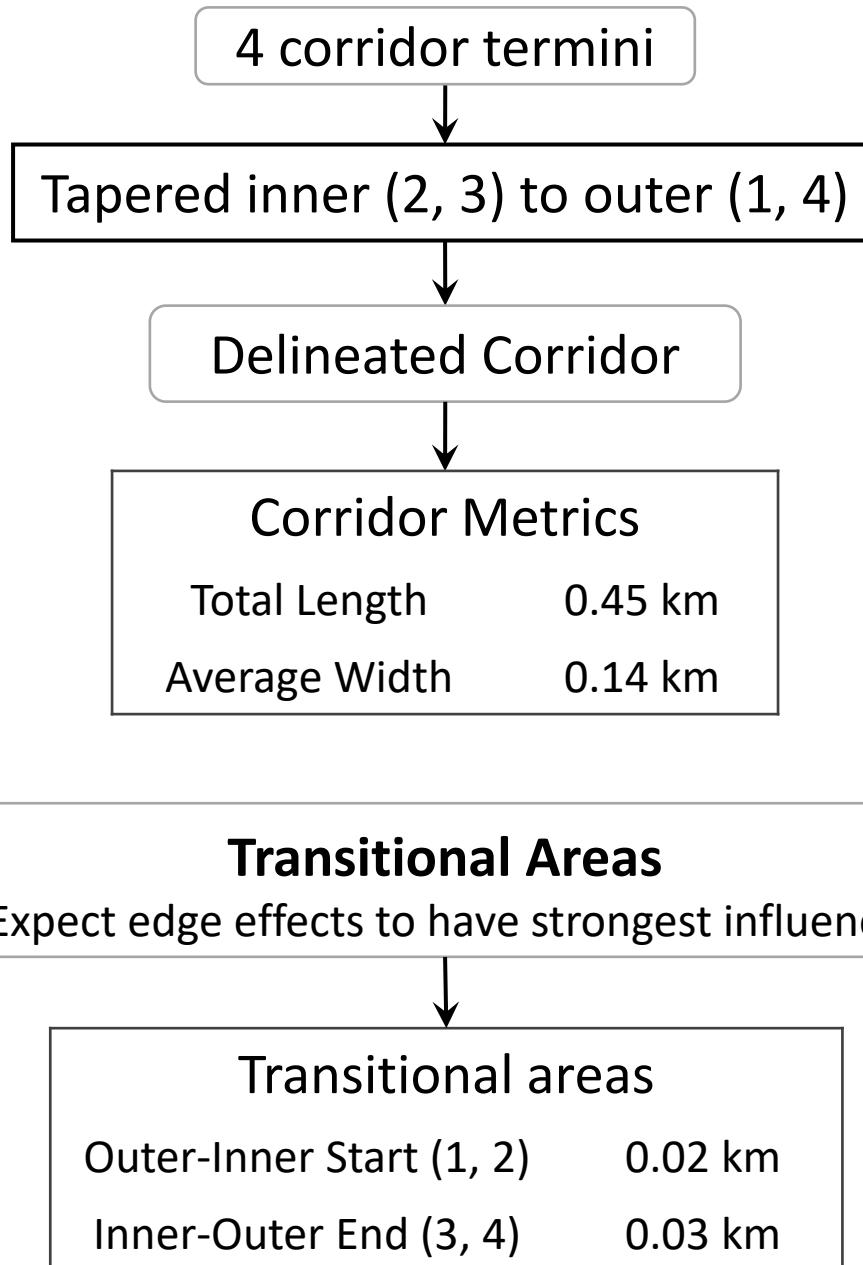
(3) Inner end

(4) Outer end

4 corridor termini



2) Identify ambiguous transitional areas of patch-corridor interfaces

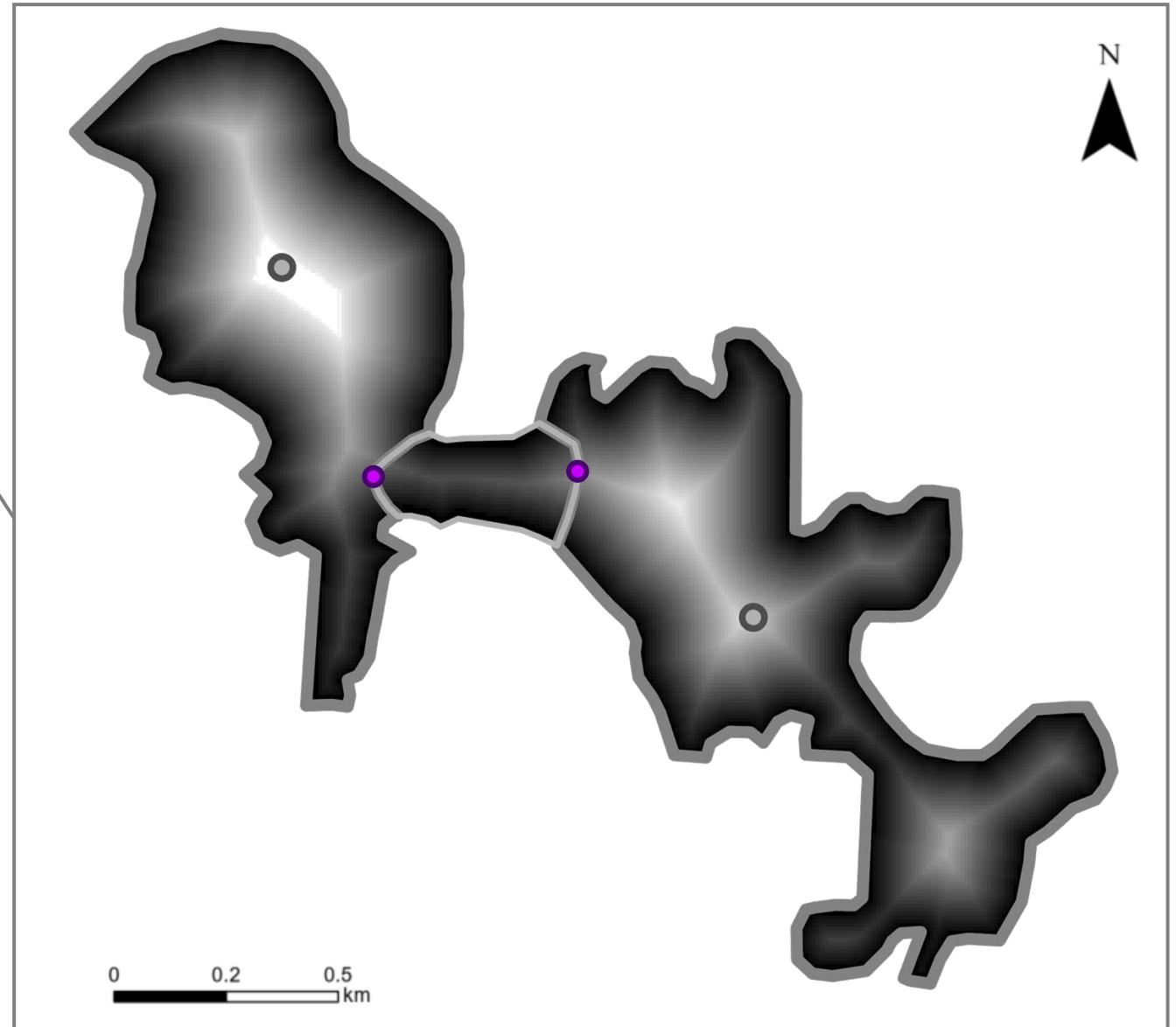


2) Identify ambiguous transitional areas of patch-corridor interfaces

Patch-Corridor-Patch

- Corridor
- Patches
- Maximum Patch Width
- Corridor Termini

Points used for objective 3



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White-footed mouse
(*P. leucopus*)

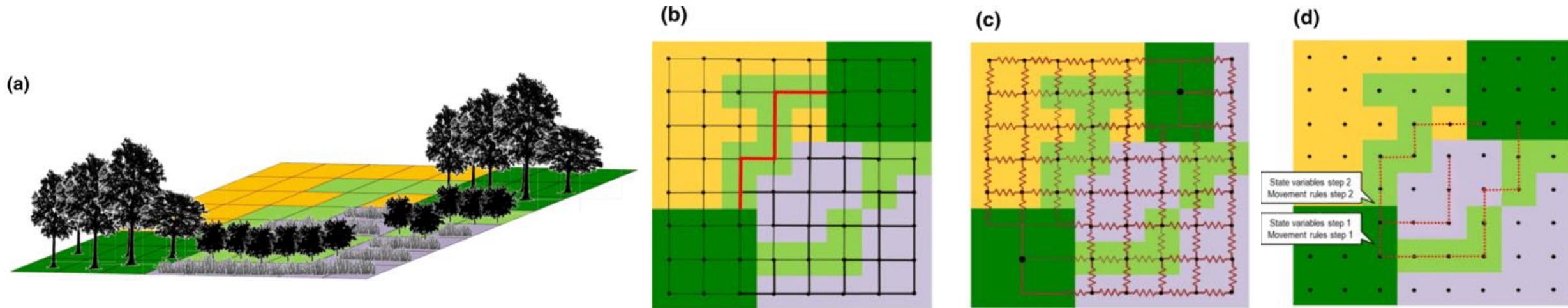


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Resistance-based Connectivity Modelling



Least-cost Path

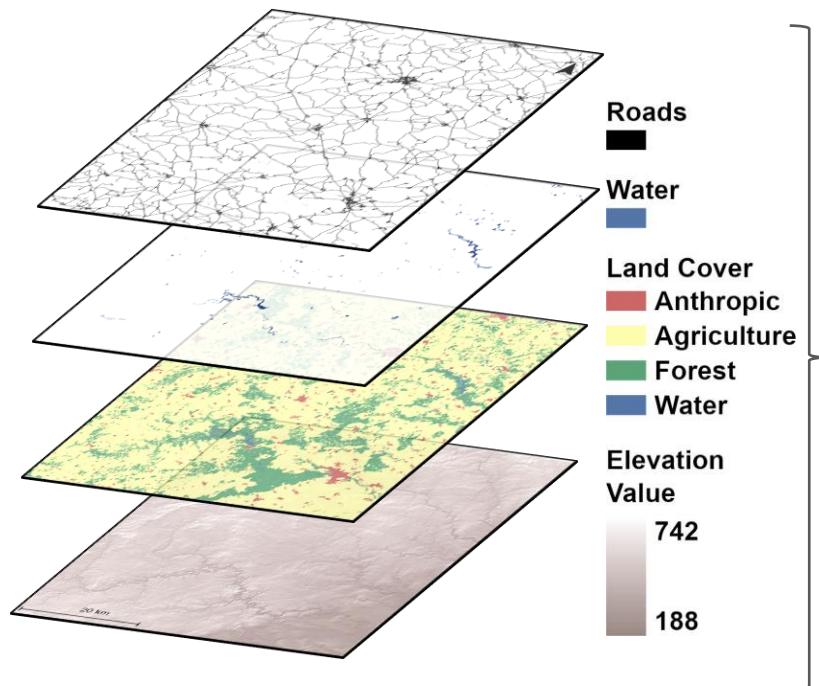
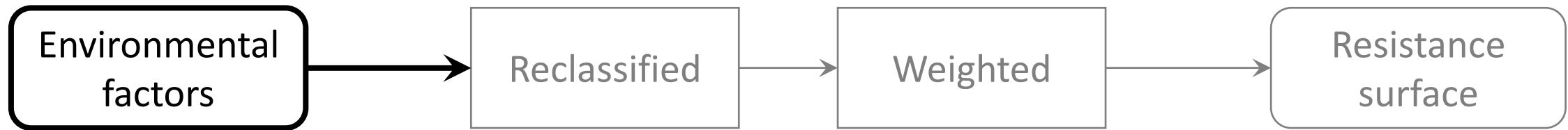
- Assumes complete knowledge of landscape
- Does not consider several potential dispersal paths

Current Flow

- Assumes no knowledge of landscape
- Predicts dispersal across all potential paths
- Implements species responses to structural patterns that drive processes

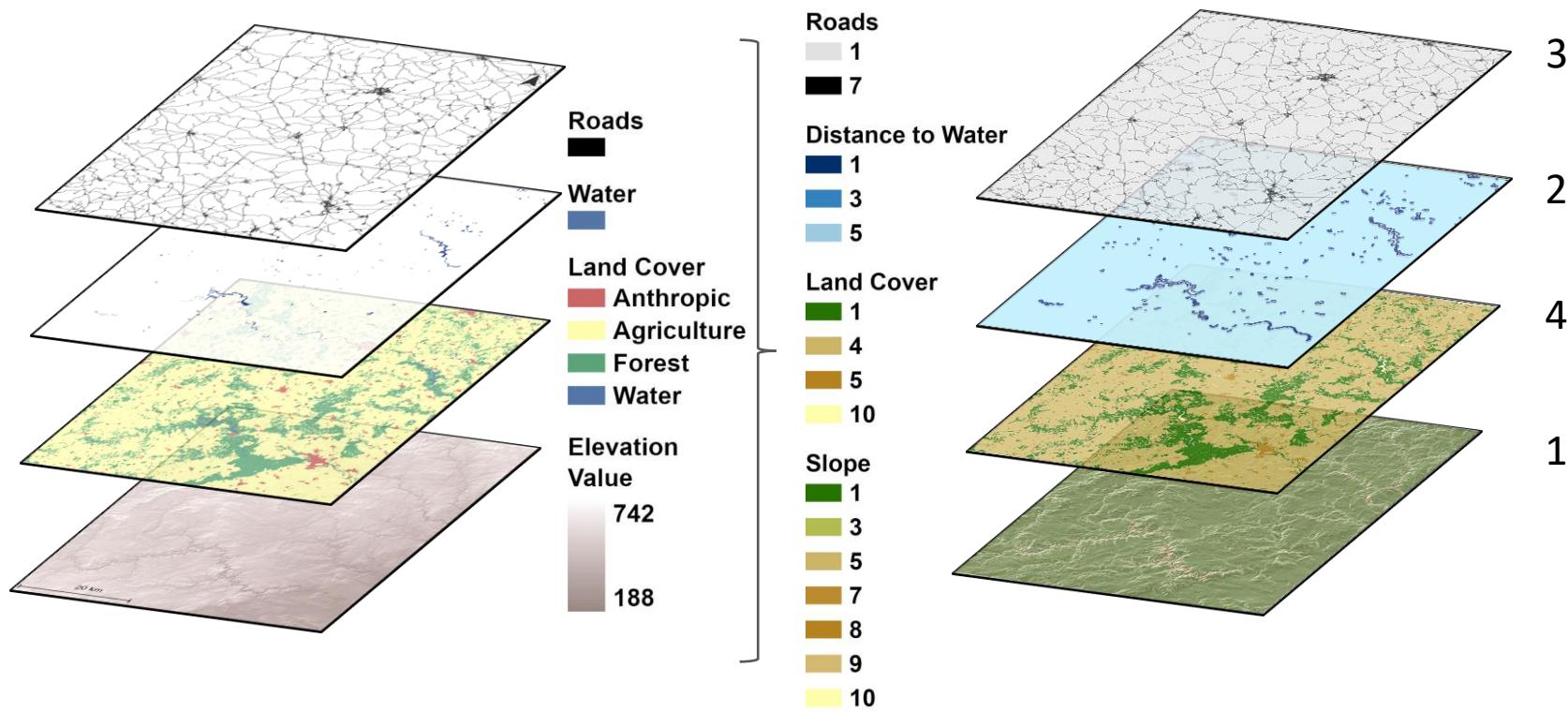
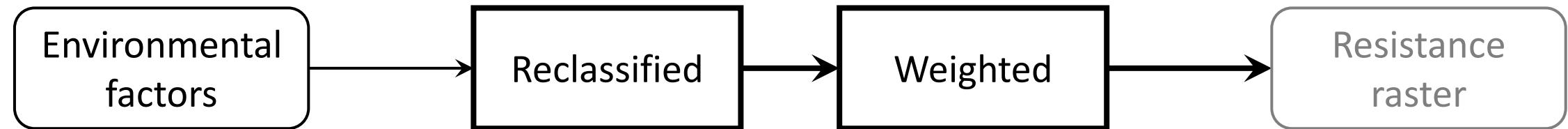
(McRae 2006; Diniz et al. 2020)

3) Assess focal species responses to the heterogeneity of landscapes



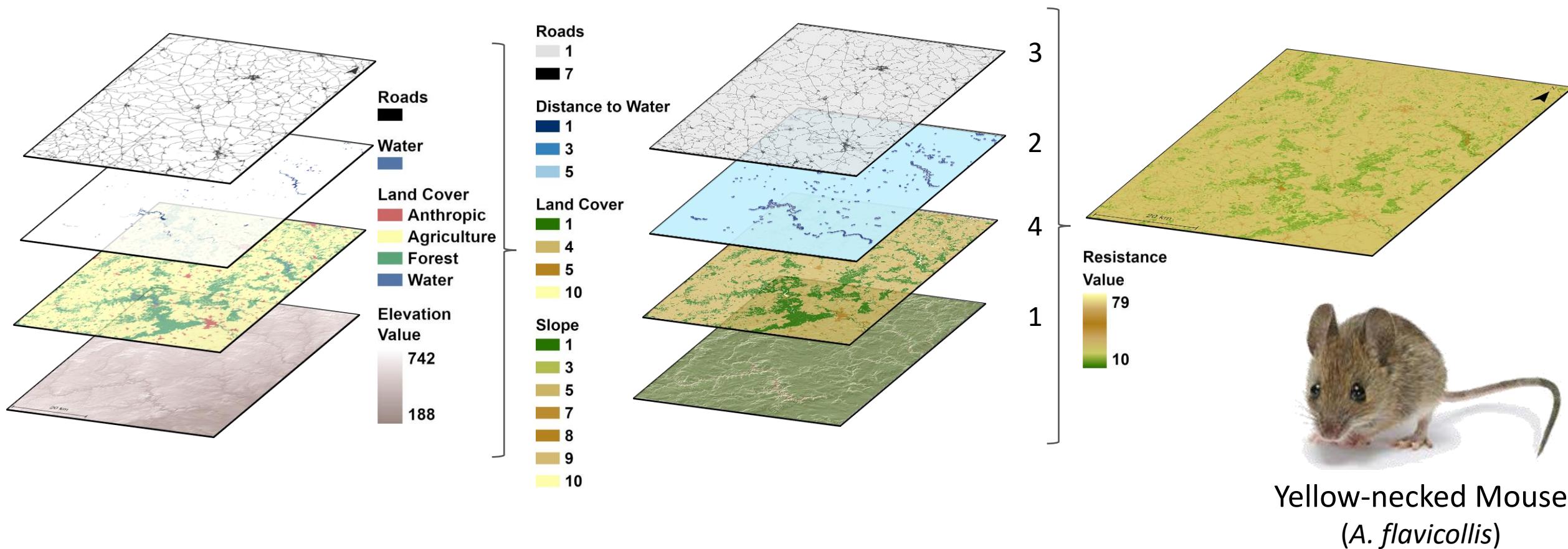
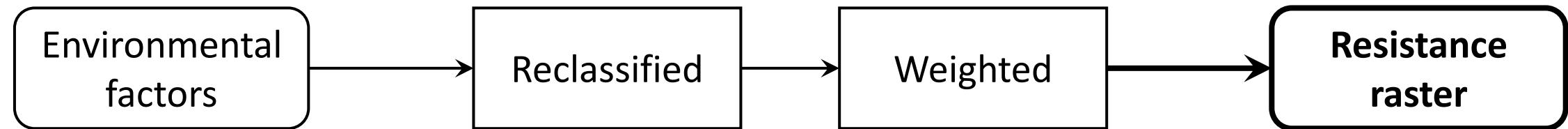
Yellow-necked Mouse
(*A. flavicollis*)

3) Assess focal species responses to the heterogeneity of landscapes



Yellow-necked Mouse
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3) Assess focal species responses to the heterogeneity of landscapes

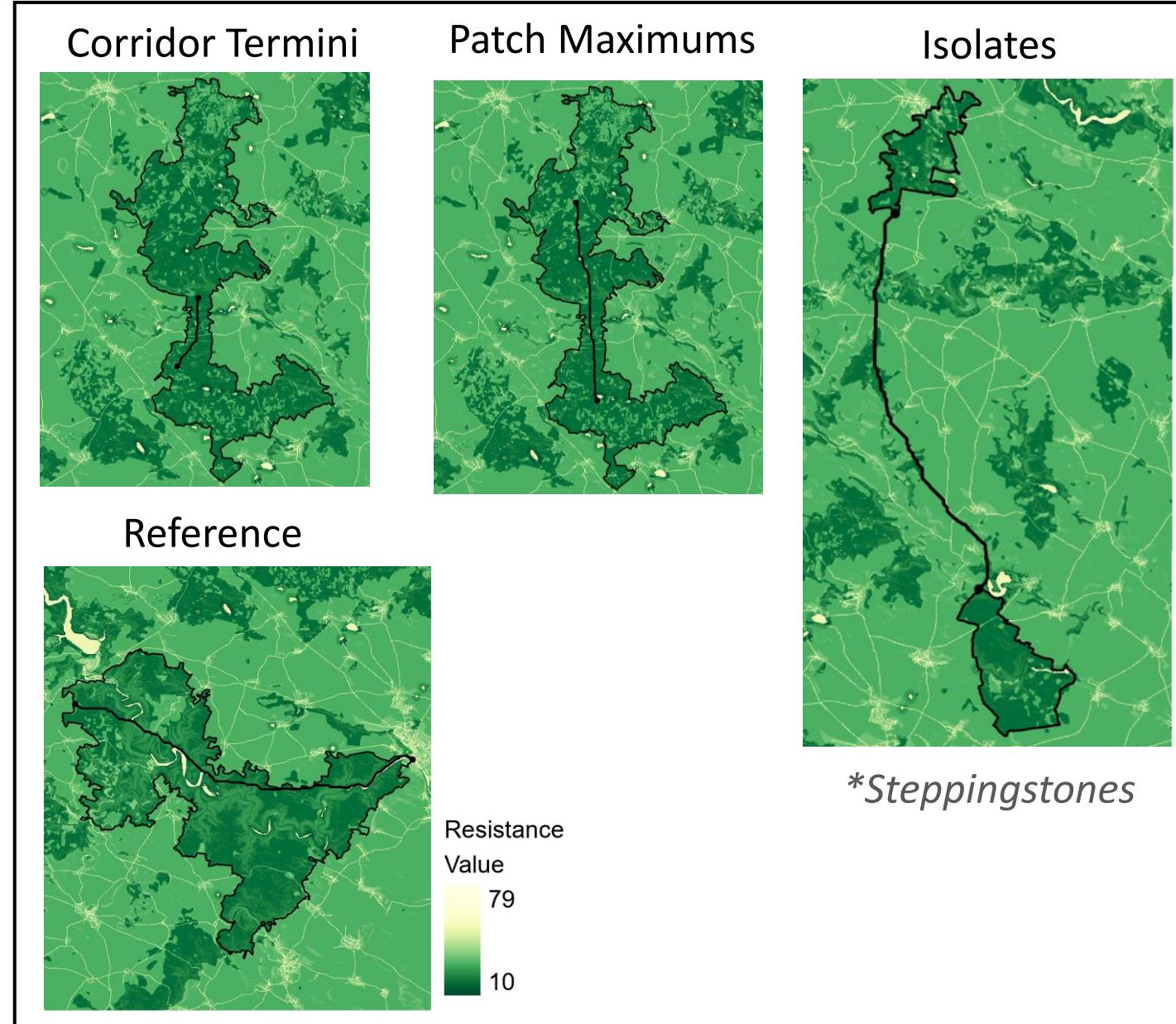
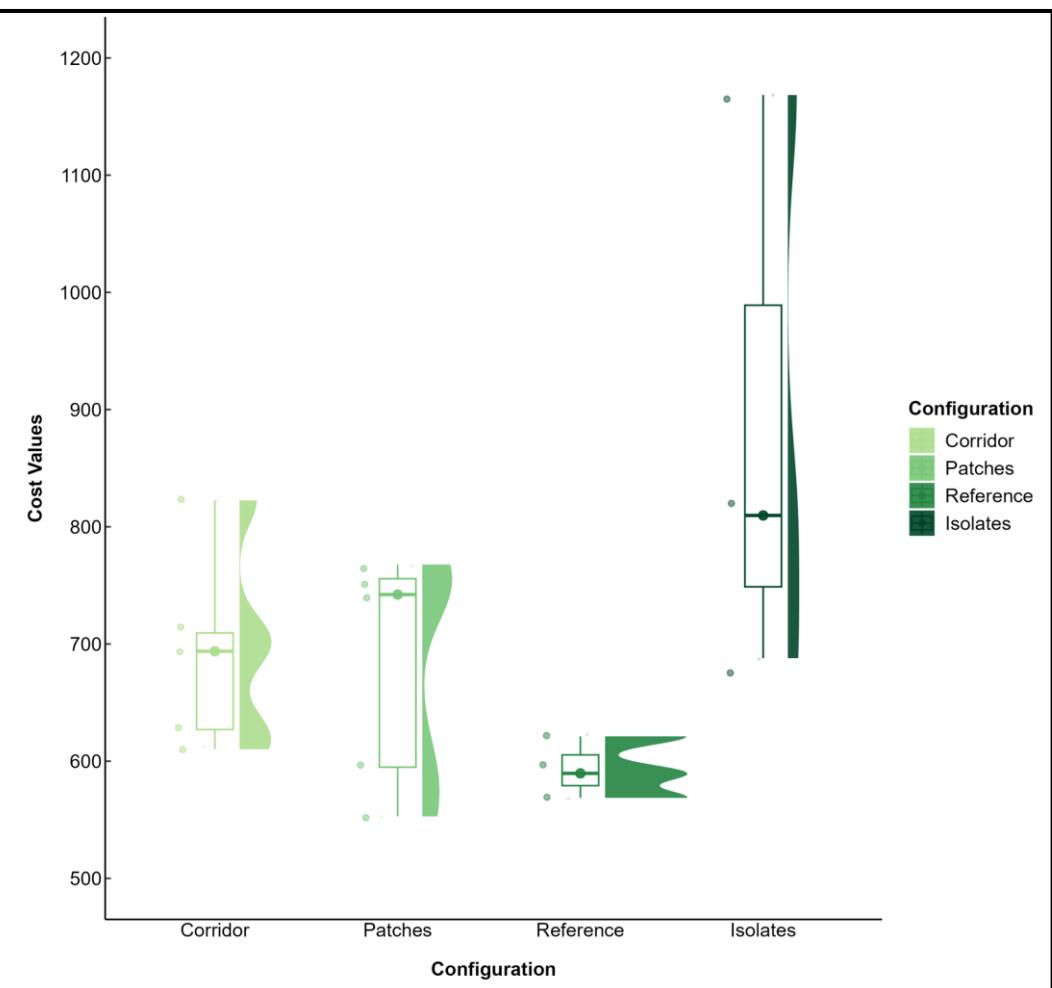


3) Assess focal species responses to the heterogeneity of landscapes

Least-cost Path

Single path
All landscapes

Lowest: References
Highest: Isolates

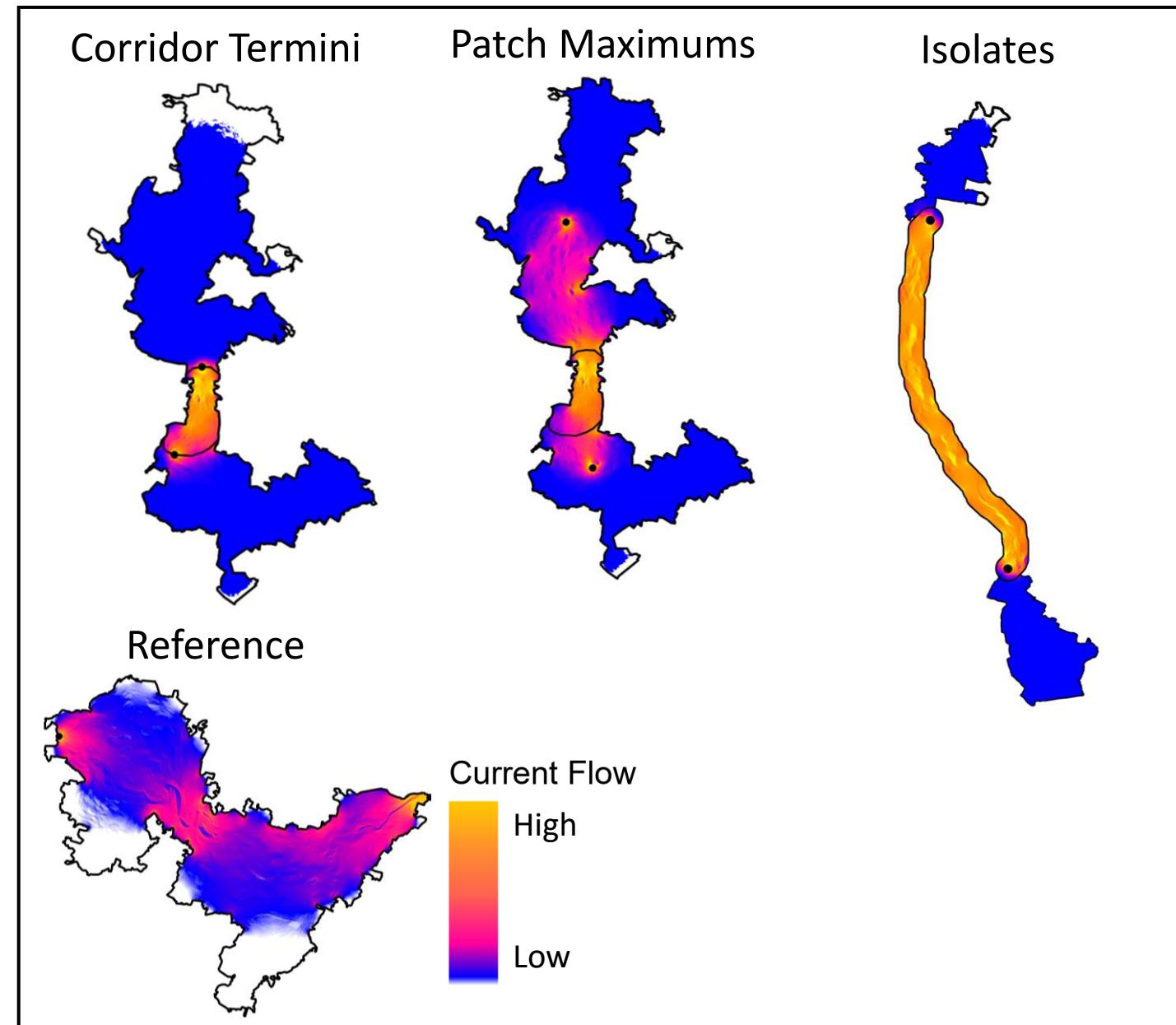
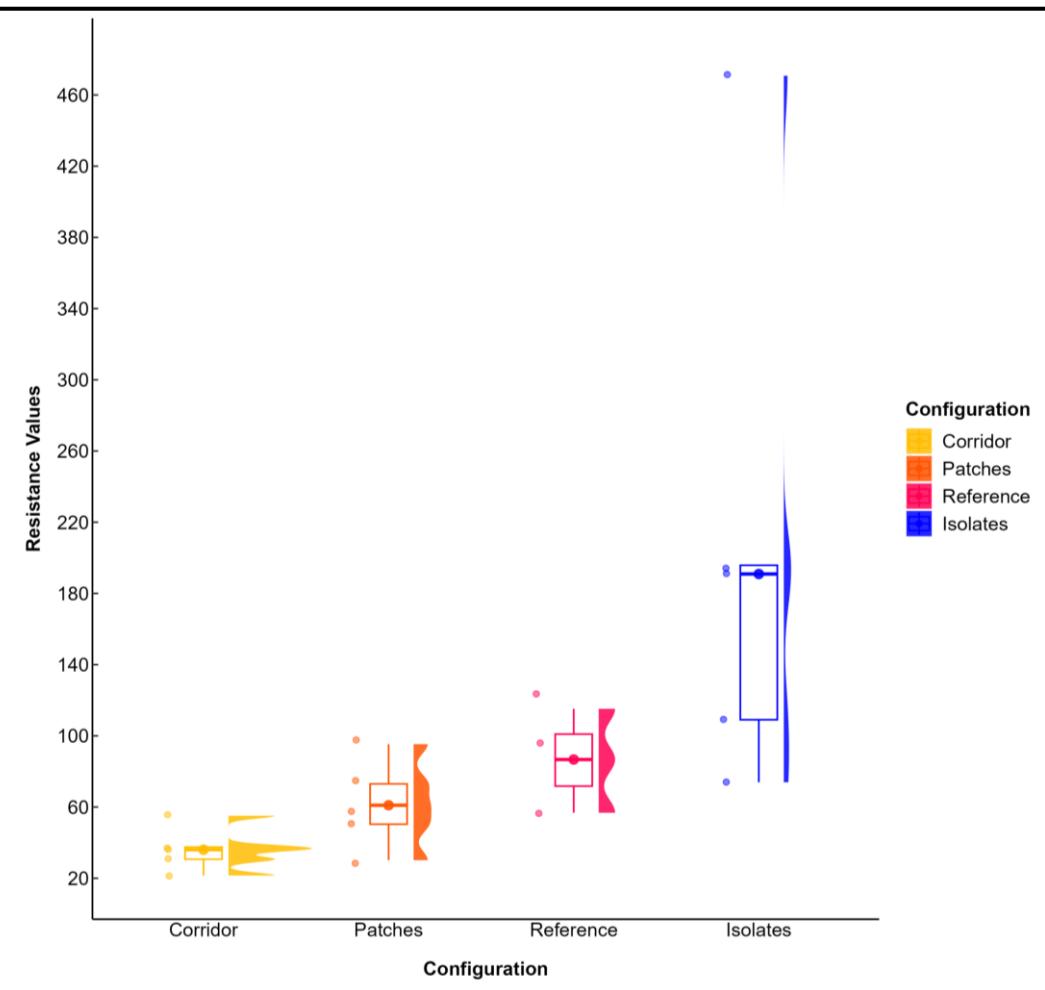


3) Assess focal species responses to the heterogeneity of landscapes

Current Flow

Several paths
All landscapes

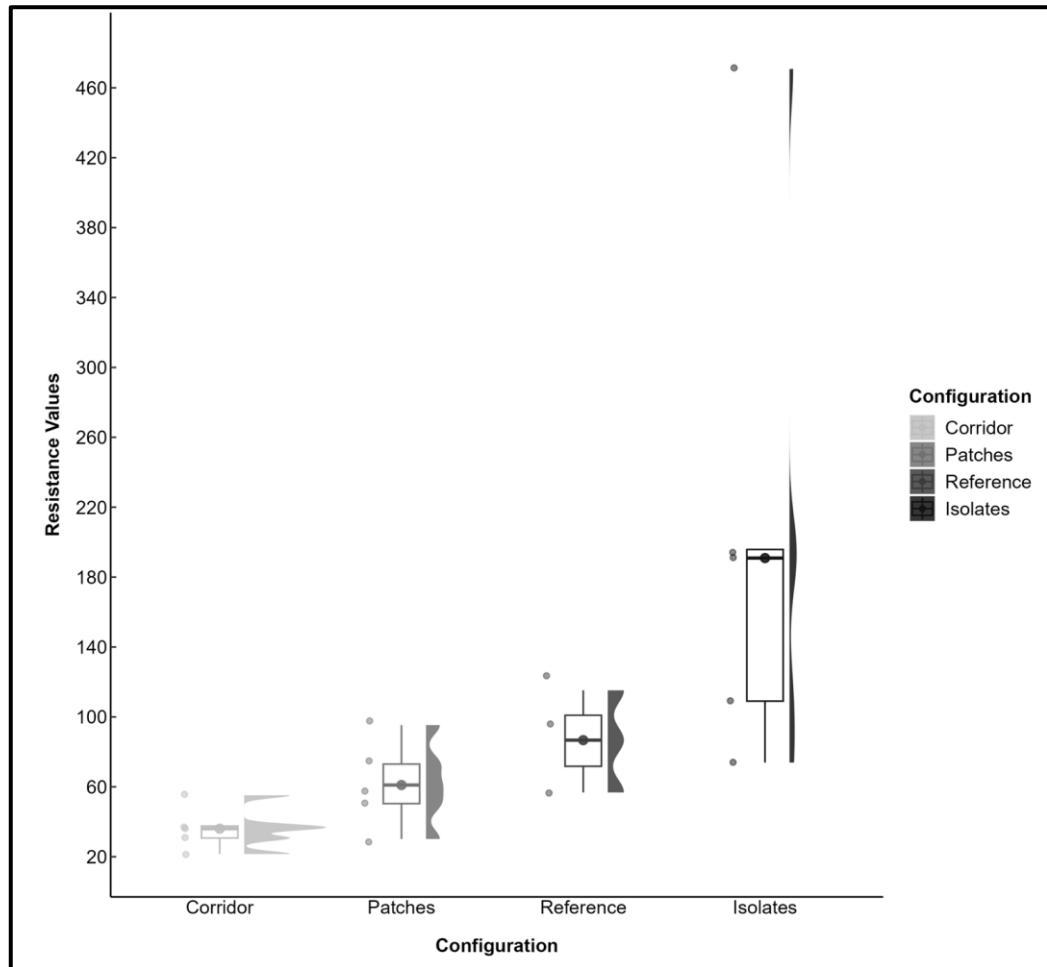
Lowest: Corridors
Highest: Isolates



3) Assess focal species responses to the heterogeneity of landscapes

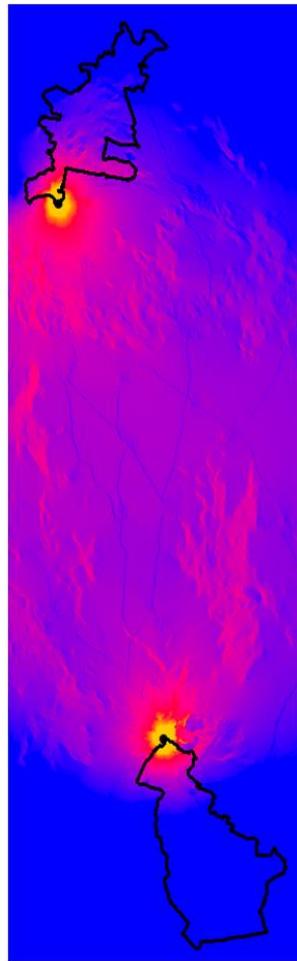
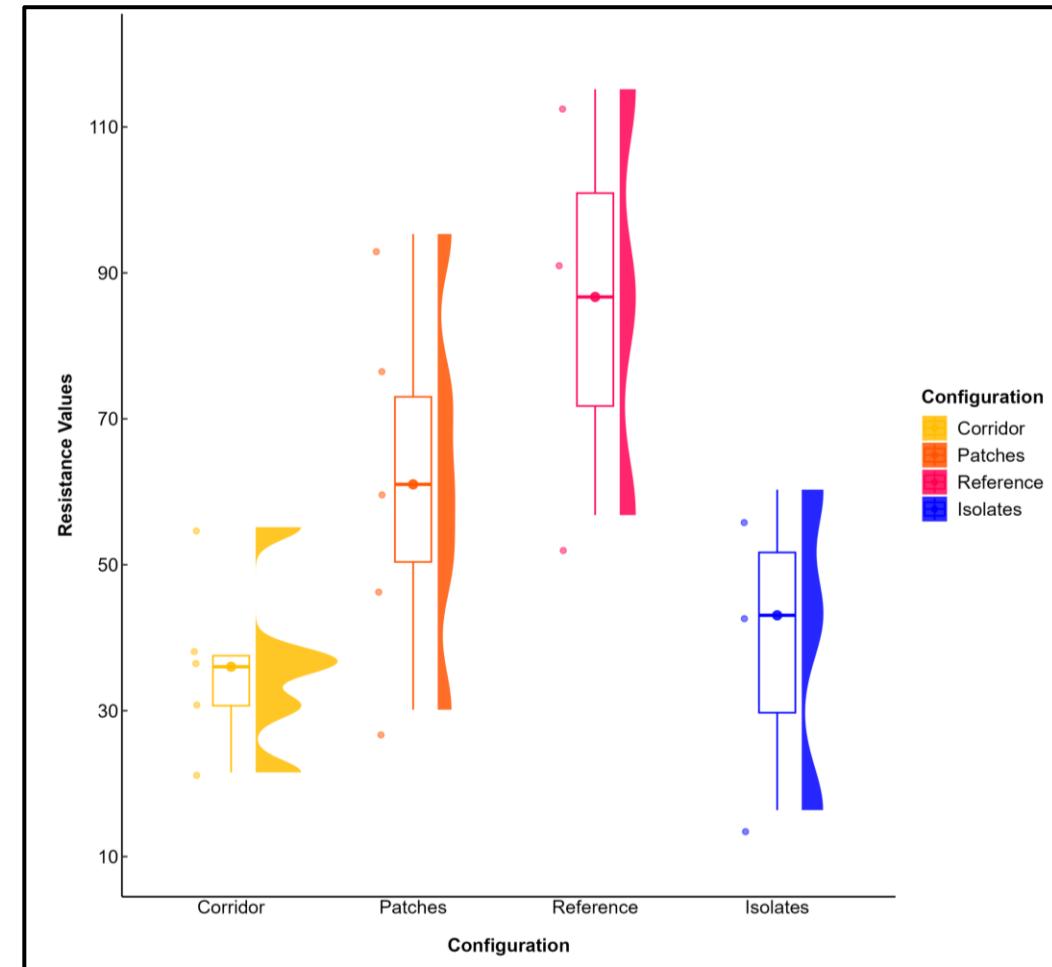
a Current Flow

Isolates forced through average widths



b Current Flow

Isolates through matrix



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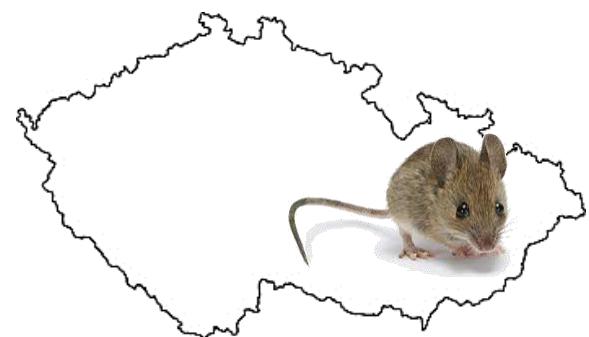
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Conclusions

This research furthers our understanding of complex real-world patterns and processes we don't have a foundational understanding of

- Ignite conversations

Meaningful corridor termini is critical to understand efficacy

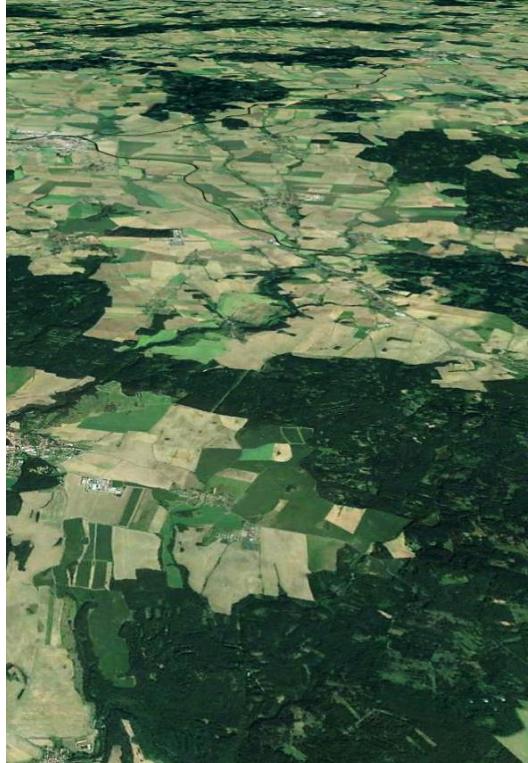
- Transition zones useful for where we expect edge effects

Real-world corridors more complex than experimental

- Critical to assess species response to heterogeneity
- Where conservation corridors are identified

Functional connectivity in absence of structural via steppingstones

- Do corridors matter?



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Future Research

Continue to address critical knowledge gaps

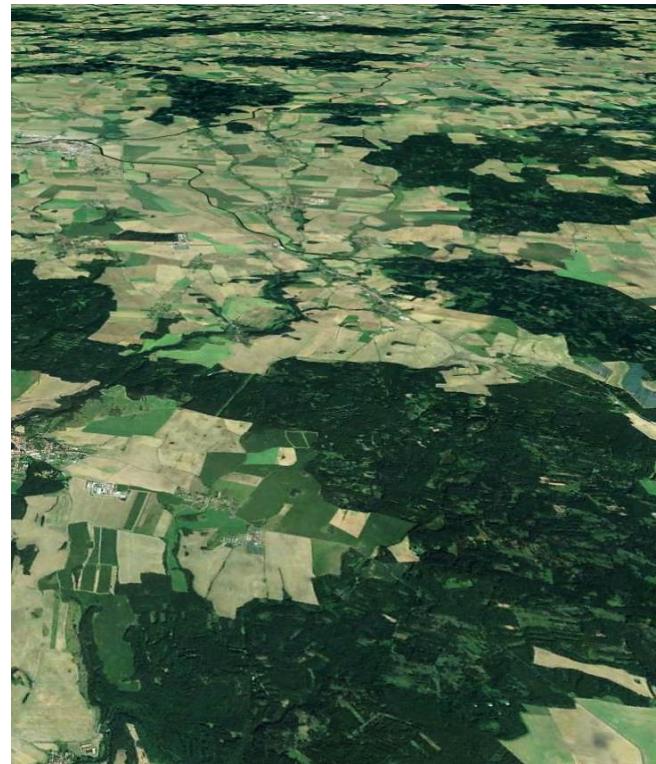
- Methods developed here to be built upon

Evaluate connectivity across landscapes vs patch elements

- Matrix quality influences connectivity in absence of structural

Assess corridor functionality using gene flow

- Larger Corridors Project



Acknowledgements

Committee Members

Dr. Andrew Gregory

Dr. David Hoeinghaus

Dr. Kari Northeim

Corridors Project Team

Dr. Paul Beier

Dr. James Bullock

Emma Spence

Dr. Justin Travis

Mentors

Dr. Jaime-Baxter Slye

Dr. Bradley Swanson



Natural
Environment
Research Council



Acknowledgements



Questions

