

A photograph of a turtle crossing a road. The turtle is in the foreground, moving from left to right. In the background, a silver car is driving away on the road. The scene is outdoors with trees and a cloudy sky.

ECS Lunch and Learn

Supporting internal knowledge transfer within TRCA

September 14, 2021

Urban Landscapes, Biodiversity, and Habitat Connectivity

Andrew Chin^{1,2}, Namrata Shrestha¹, Jonathan Ruppert^{1,2}, Tiziana Gelmi Candusso², David Lawrie¹, Marie-Josée Fortin²

¹ Toronto and Region Conservation Authority, Vaughan, ON

² Department of Ecology and Evolutionary Biology, University of Toronto, Toronto, ON



UNIVERSITY OF
TORONTO

TRCA Lunch and Learn
September 14, 2021

Habitat Connectivity

Maintaining landscape connectivity completing their life-history needs

- Access to habitat
- Long-term persistence in the landscape



Road Networks

Roads negatively affect wildlife populations

- Direct effect:
 - injury/mortality through road construction
 - wildlife-vehicle collisions
- Indirect effects:
 - modified behavior (road avoidance)
 - altered physical and chemical environments
 - spread of exotic species



Urban Ecosystems

- Landscape connectivity is critical in urban areas where the remaining habitat patches are small and highly fragmented



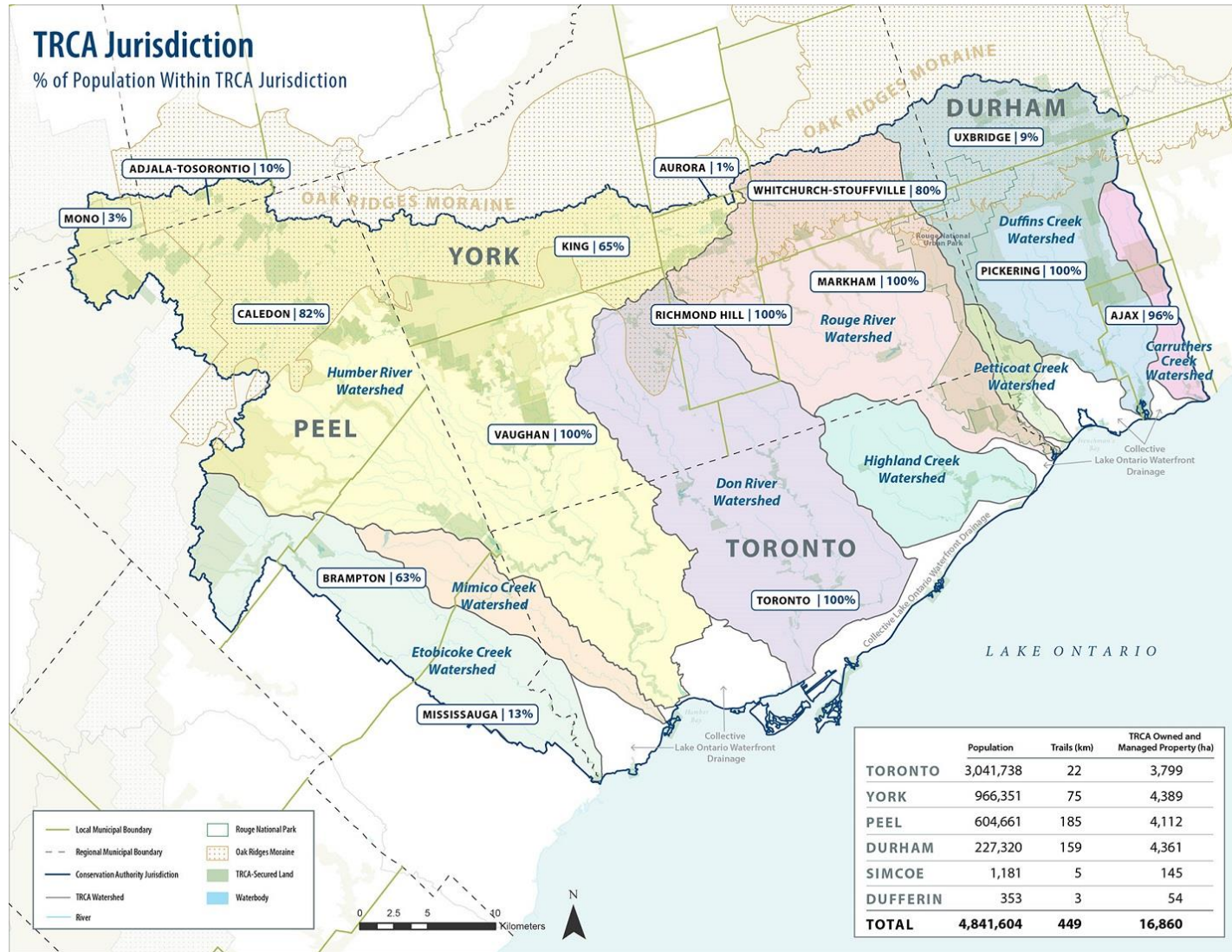
Objectives

1. Assess the regional connectivity priorities through a broad connectivity model
2. Regional connectivity priorities based on habitat patch types with amphibian movement guilds
3. Prioritization of ecopassage implementation based on watershed-level results

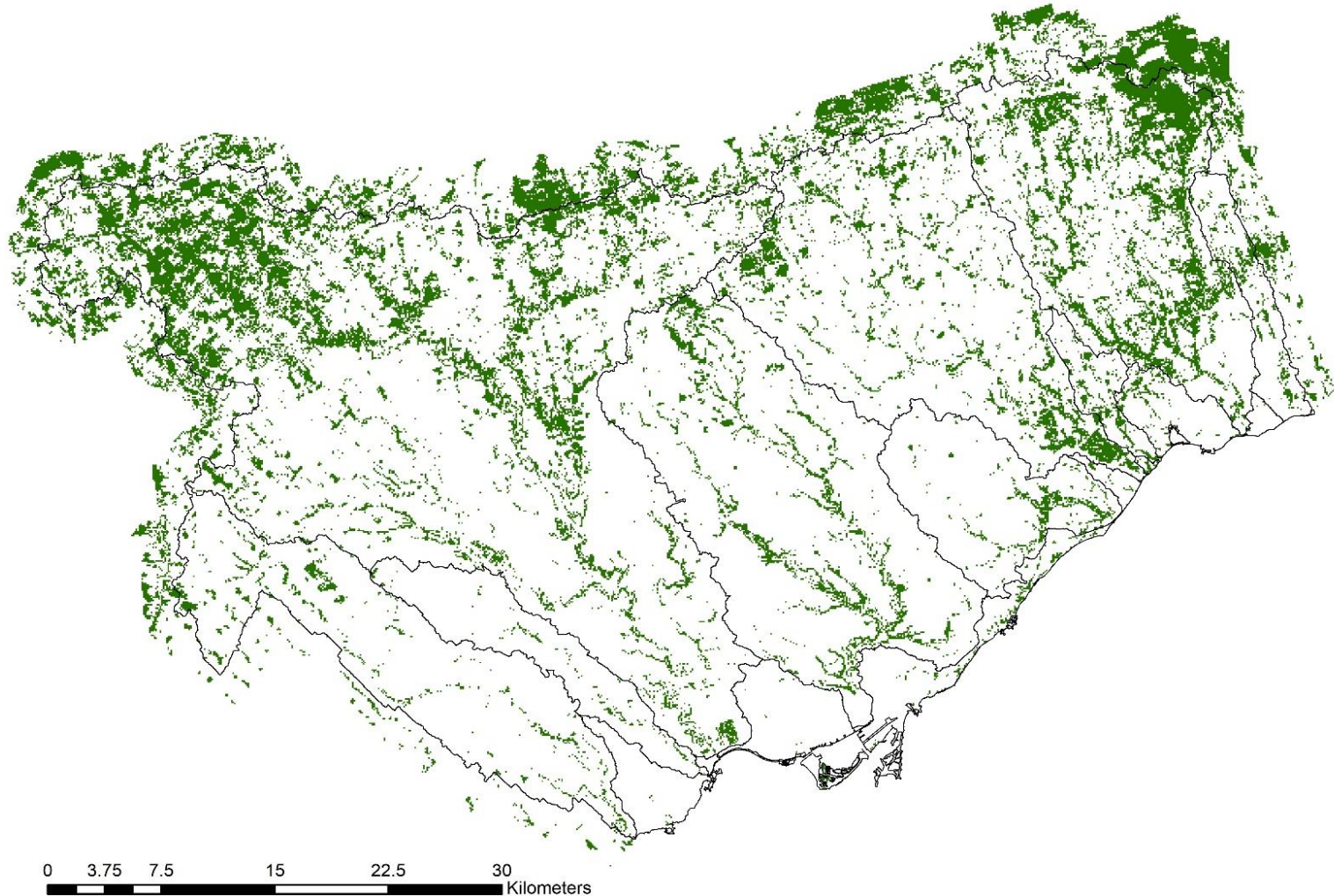
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3. Prioritization of ecopassage implementation based on watershed-level results

Study Region

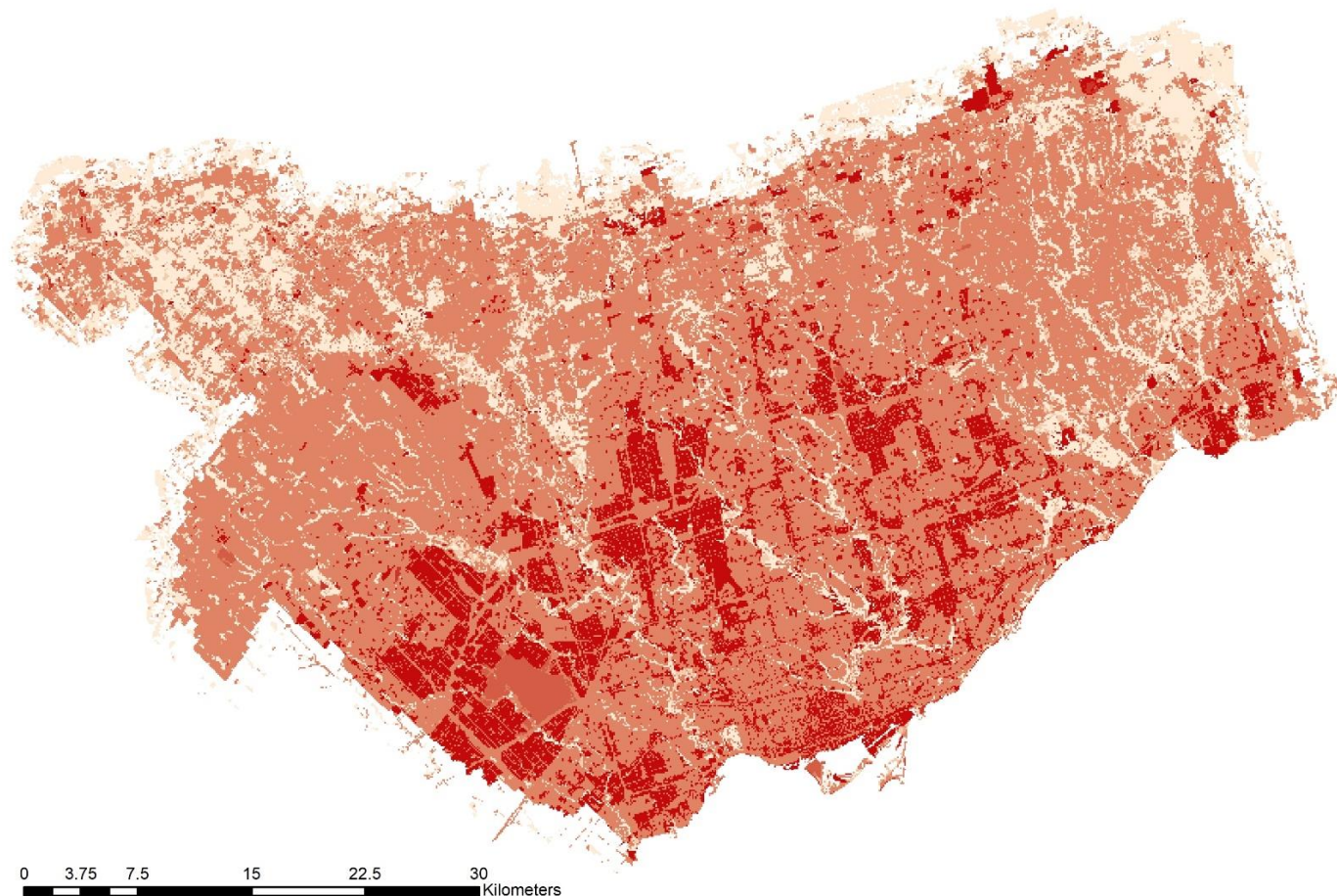


Habitat across the Landscape



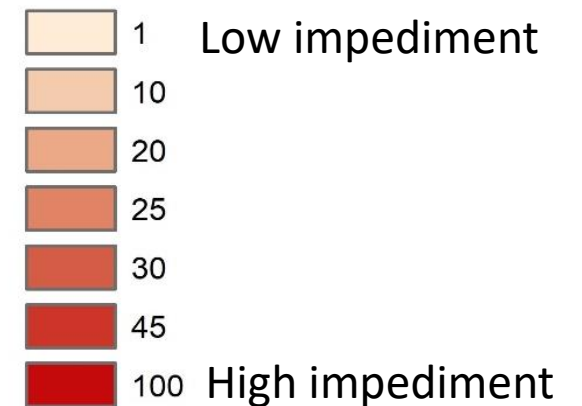
Example:
Forest habitat patches

Impediment to Movement



Example:
Resistance layer for
forest-wetland dependent species

Resistance value



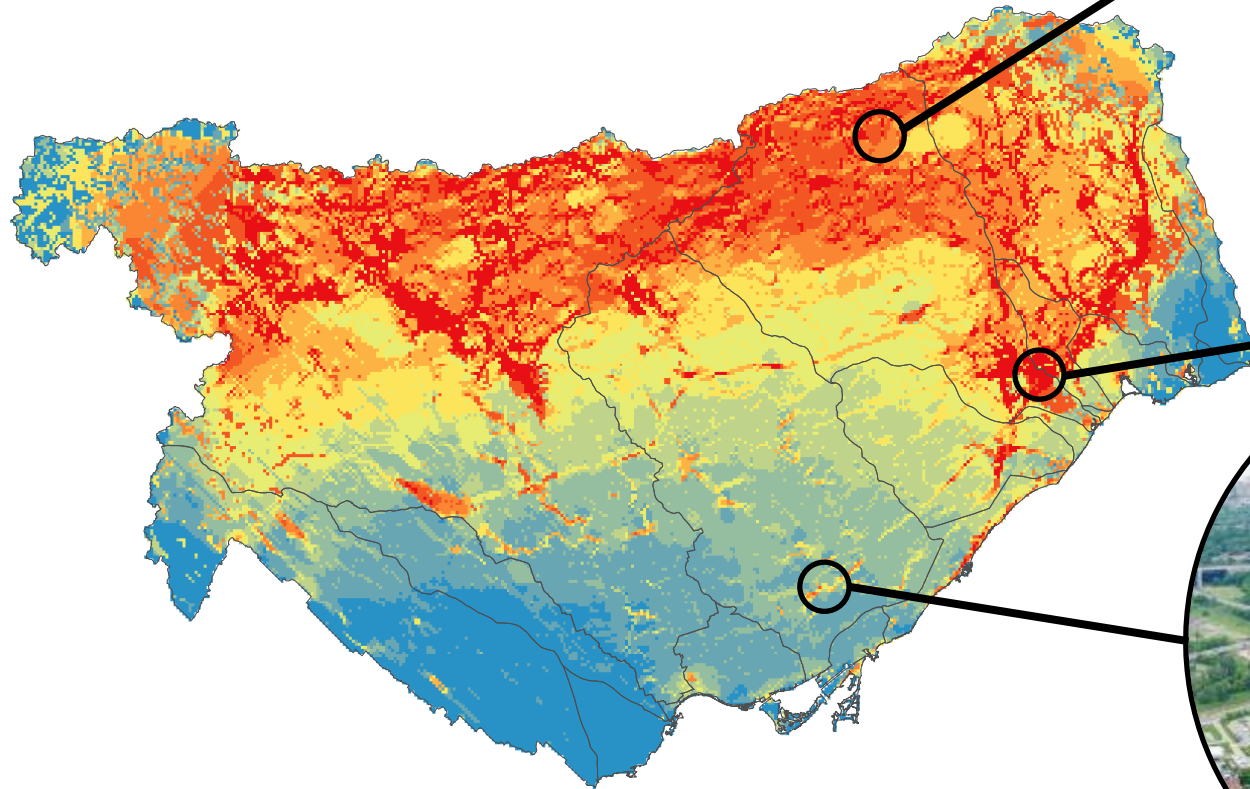
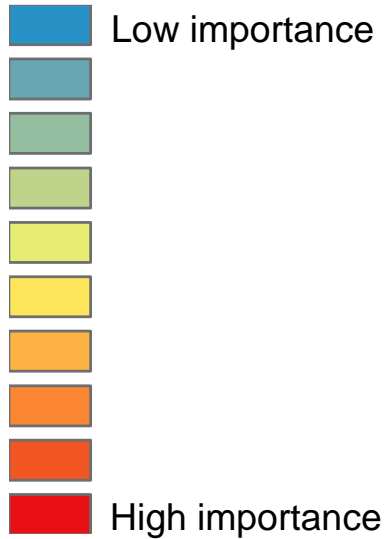
Method: Circuitscape

- Circuitscape (McRae et al. 2008) is a tool that identifies the locations that we cannot lose – the only pathways that if lost will compromise regional connectivity
- Identify regional corridors
- Identify regional movement guild-based corridors
 - Amphibians: wetland-wetland and forest-wetland connectivity

Habitat Patches (Nodes) + Resistance Layer = Circuitscape Output

Regional Connectivity

Pinchpoint connectivity
(quantile)



Agriculture



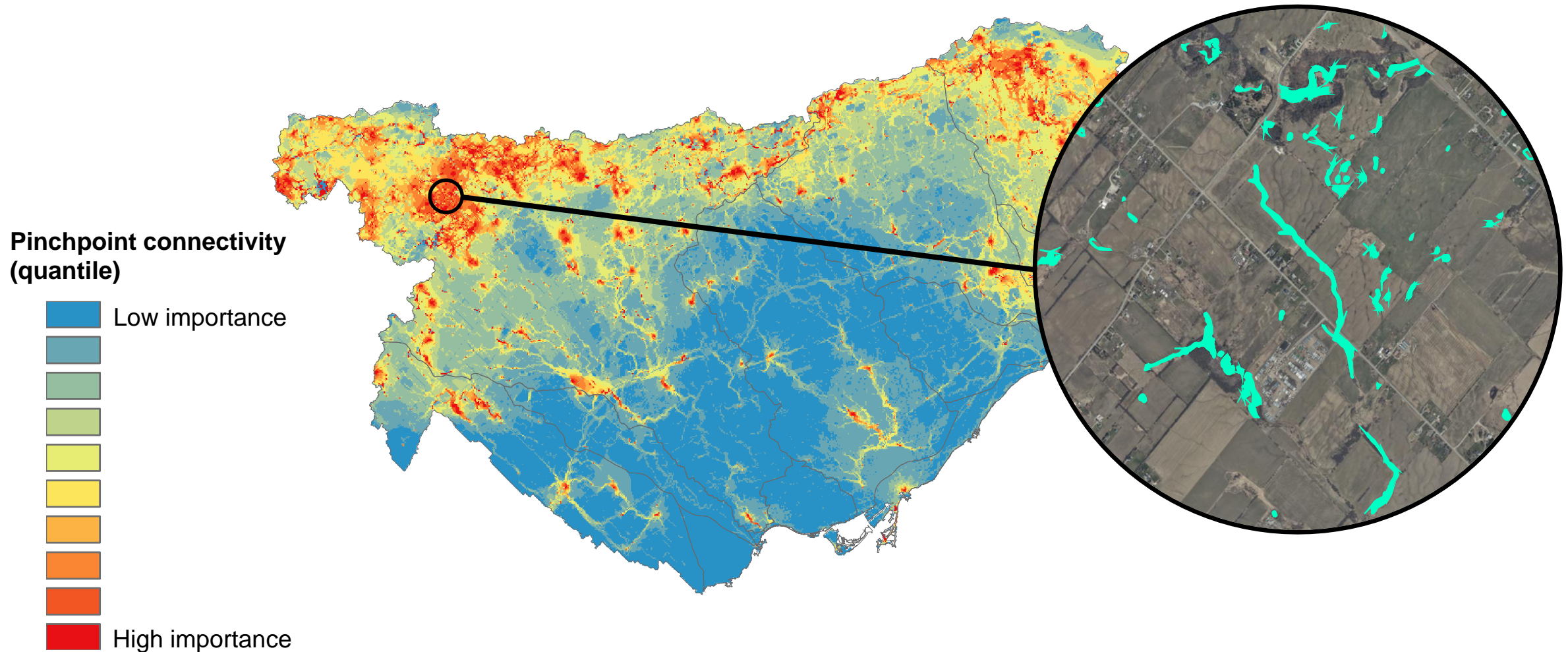
Ravines



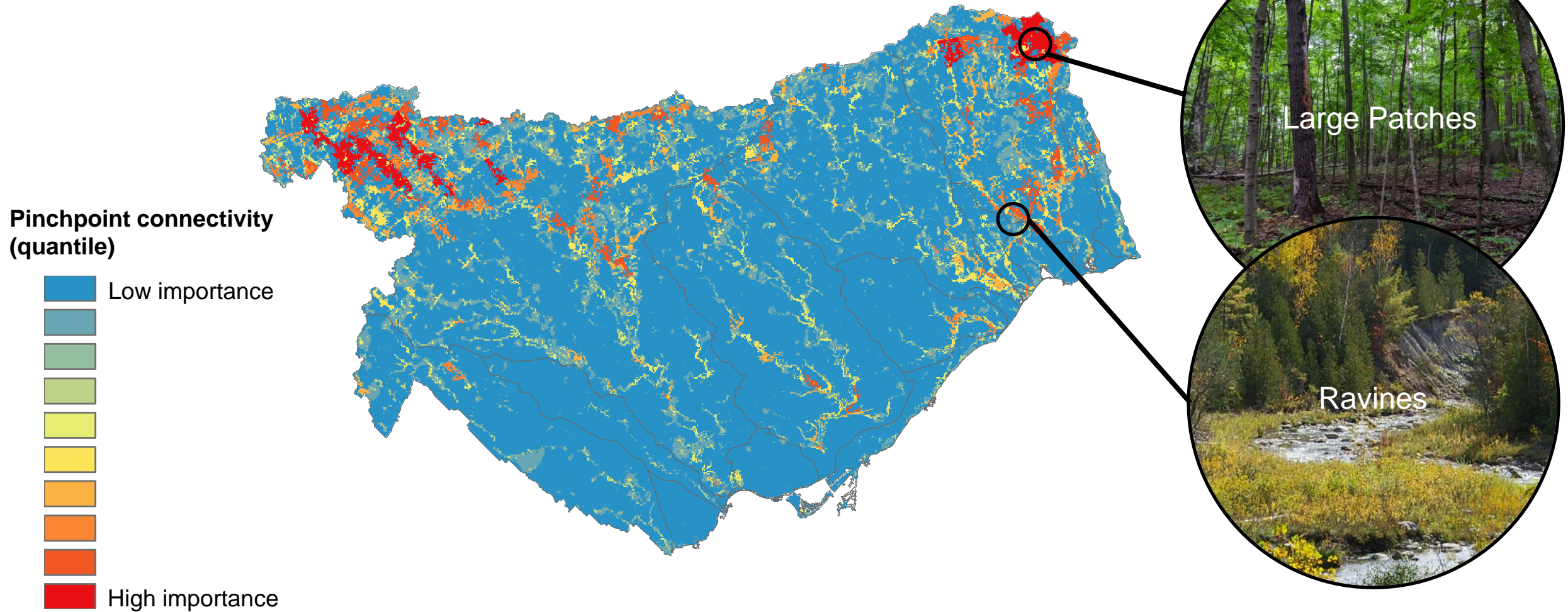
Urban Ravines

Amphibian Habitat Connectivity: Wetland

Wetlands are dispersed and corridors are sparse



Amphibian Habitat Connectivity: Forest-Wetland

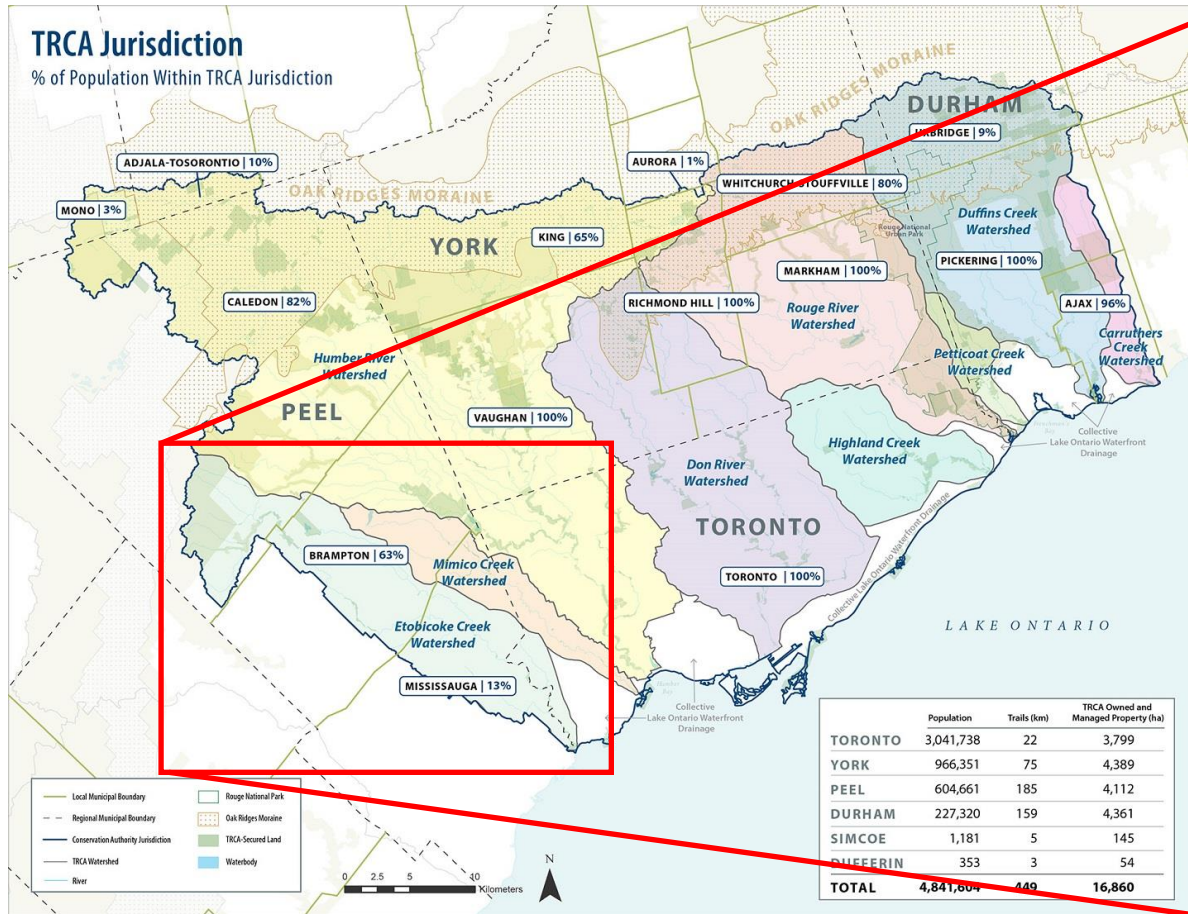


Objectives

1. Assess the regional connectivity priorities through a broad connectivity model
2. Regional connectivity priorities based on habitat patch types with broad avian and amphibian movement guilds
3. **Prioritization of ecopassage implementation based on watershed-level results**

Watershed-level Connectivity

Etobicoke Creek Watershed



Method: Linkage Mapper

Linkage Mapper (McRae and Kavanagh 2011)

- Identifies least-cost paths that provide the linkages between habitats
- Linkages are determined through cost-weighted distances

10-m resolution for resistance rasters representing movement guilds:

- Amphibian Wetland-Wetland
- Amphibian Forest-Wetland
- Mammals (Large Canines) Forest-Meadow

Habitat Patches (Nodes) + Resistance Layer

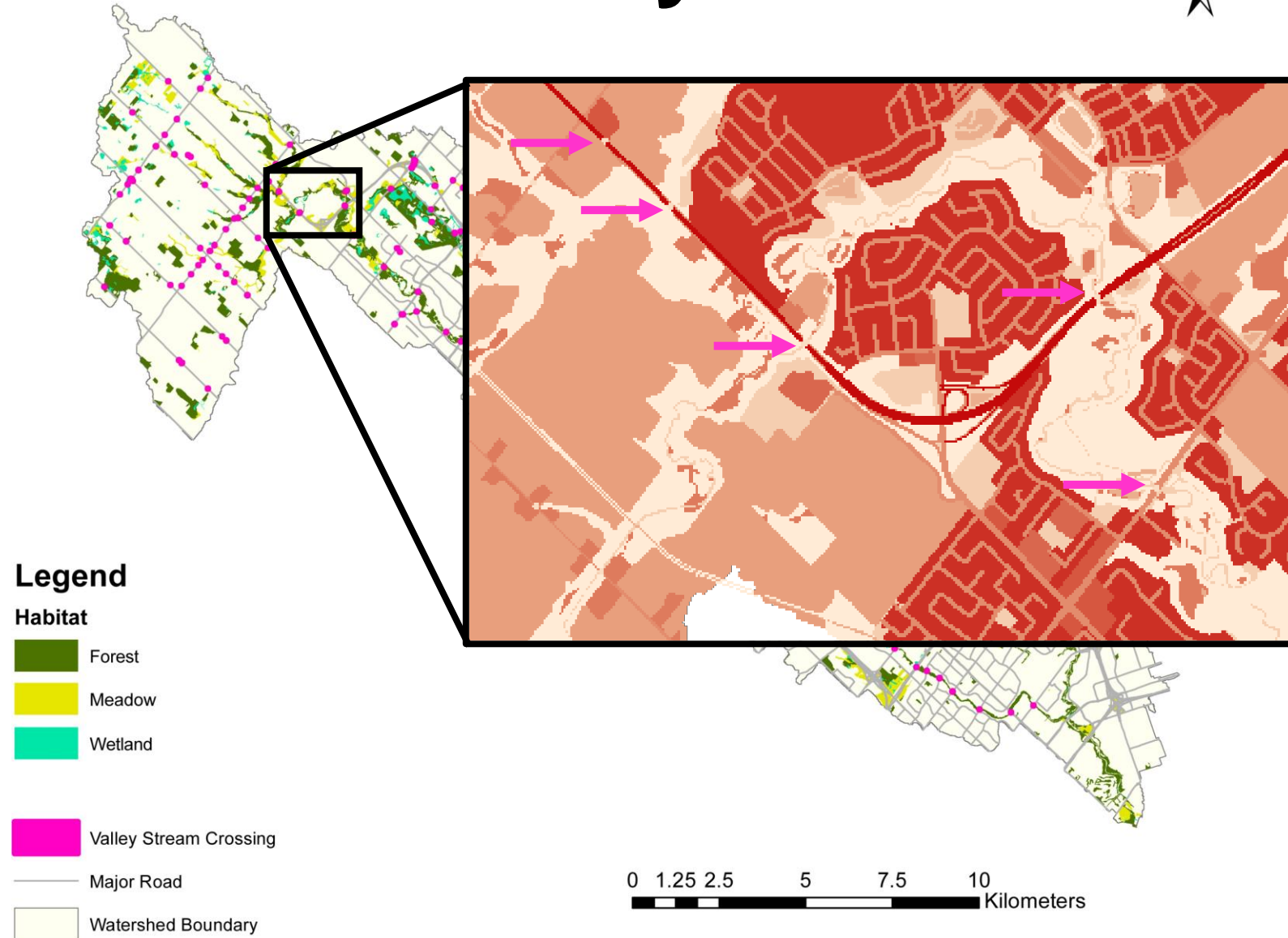
Method: Ecopassage Prioritization

1. Identify important linkages as least-cost paths for each movement guild using Linkage Mapper
2. Identify corridors as pinch points using Circuitscape
3. Least-cost paths with high pinch points (i.e. important corridors) crossing roads
4. Intersections with multiple movement guilds and high pinch point values become higher priority for ecopassage implementation or barrier improvement

Valley Stream Crossings

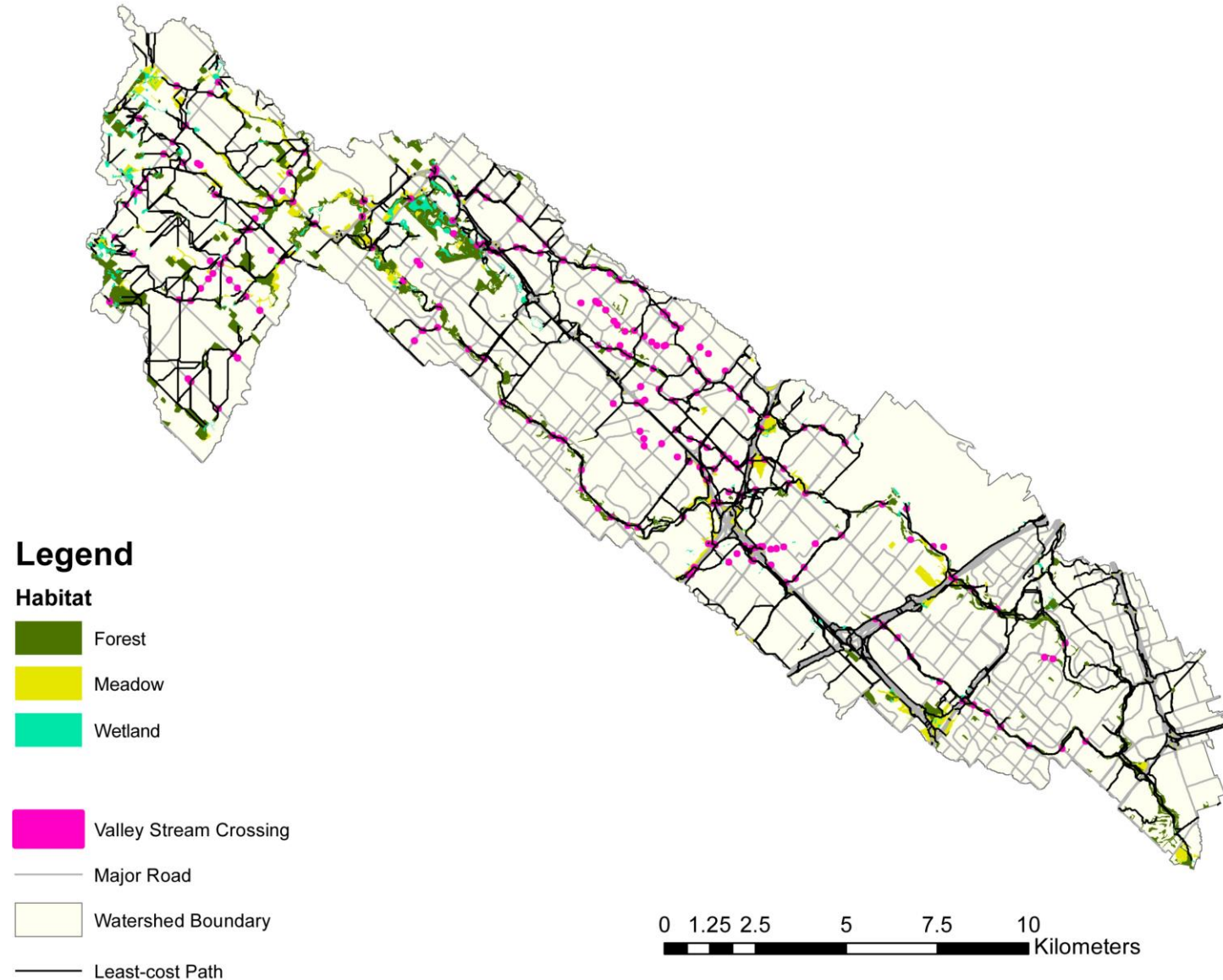


Resistance Layers

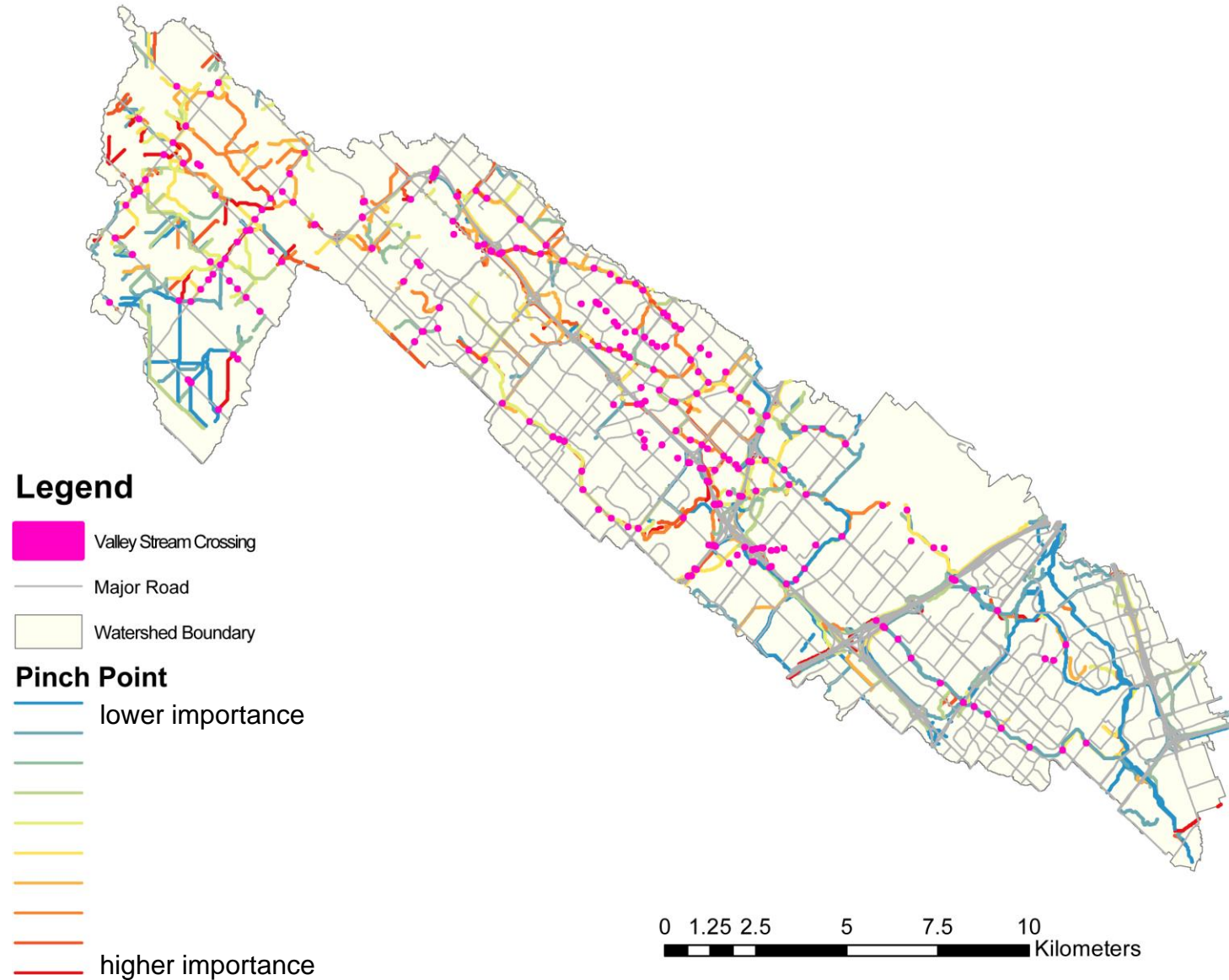


Reduced resistance at
valley stream crossings

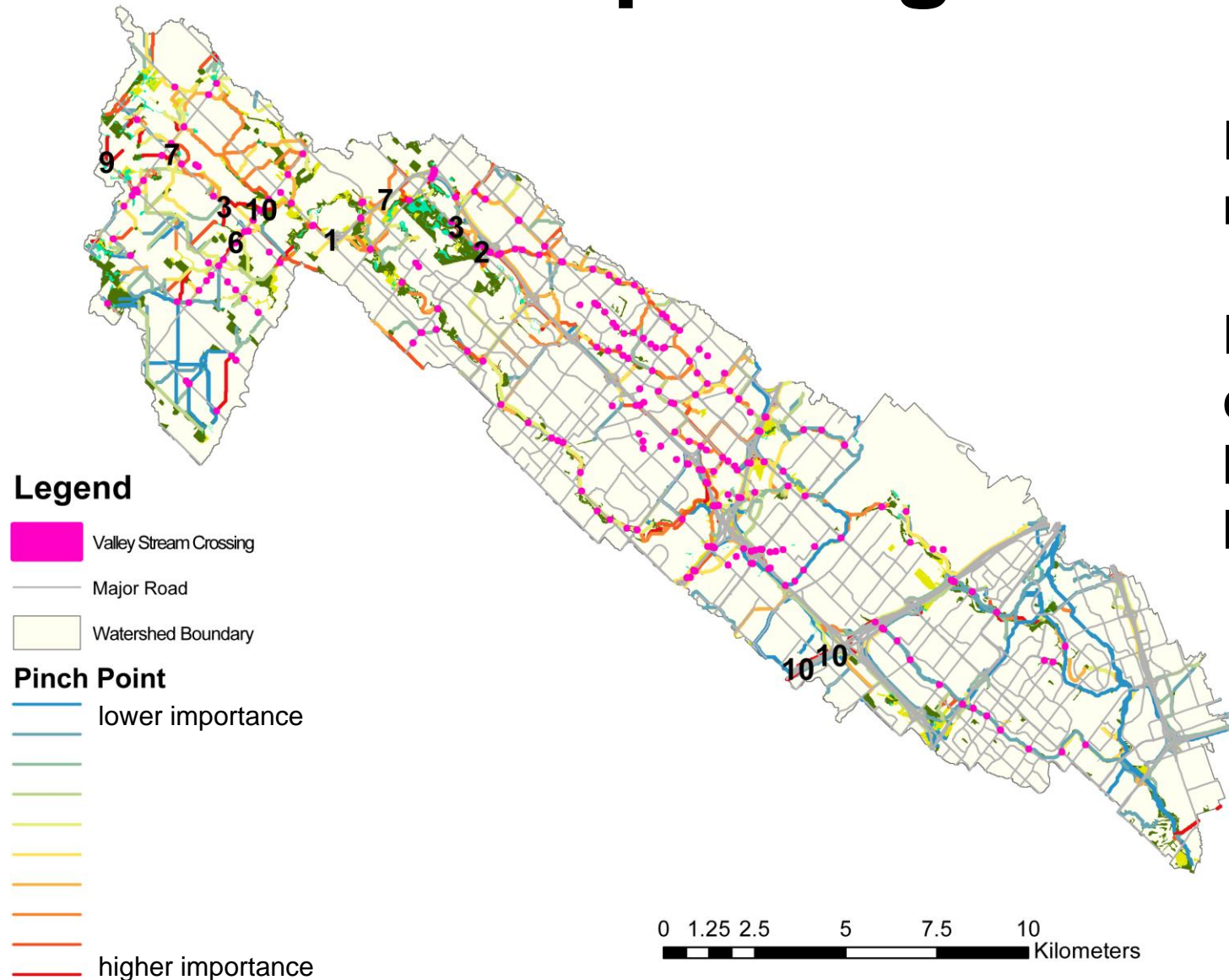
Results: Least-Cost Paths



Results: Pinch Points



Results: Ecopassage Prioritization



Highest priorities support multiple movement guilds

Implementing an ecopassage at these locations support overall landscape connectivity

Summary

- Regional connectivity maps help identify critical areas that should be maintained including future development
- Species movement guilds demonstrate that corridors could vary based on habitat needs and movement behaviour
- Informs ecopassage prioritization representing important movement corridors in the landscape

Thank You!

University of Toronto

Fortin Lab

TRCA

Paul Prior

Sue Hayes

Peel Region

York Region

Mitacs

NSERC

Wildlife-vehicle collisions and hot spot identification for roads in Peel and York Regions

Lyndsay A. Cartwright, Namrata Shrestha, David Lawrie, Jonathan Ruppert
Toronto and Region Conservation Authority

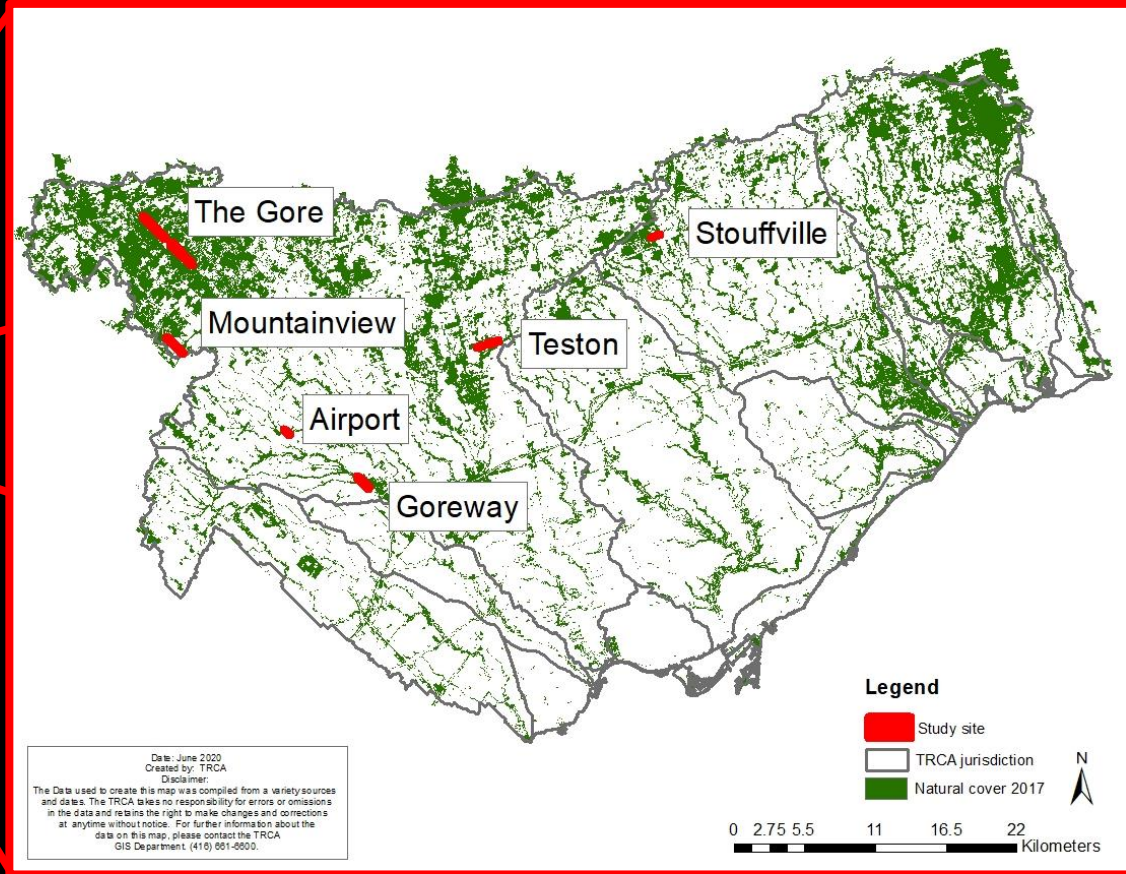


TRCA Lunch and Learn
September 14, 2021

Purpose

- Broader goals
- Summarize wildlife-vehicle collision (WVC) data collected in 2018 and 2019 at six sites in the Greater Toronto Area.
- Number of WVCs
 - Composition by taxa group, species, L1-L3, species at risk
 - Seasonal patterns
- Hot spot assessments

Methods

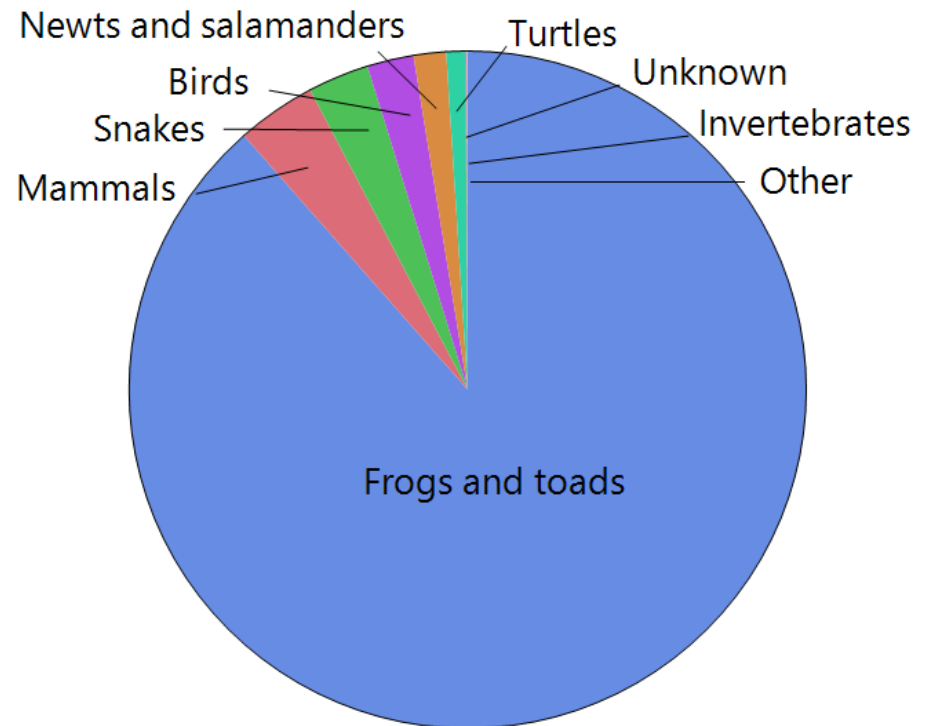


- April-November
- Day and night
- Identify/GPS

All sites combined - # WVCs by taxa

- Frogs and toads represented 89% of all WVCs

Taxa group	Total number of WVCs
Frogs and toads	7769
Mammals	334
Snakes	256
Birds	195
Newts and salamanders	136
Turtles	80
Unknown	5
Invertebrates	3
Other	1



All sites combined - # WVCs by species

- 54% of all WVCs were species of regional concern

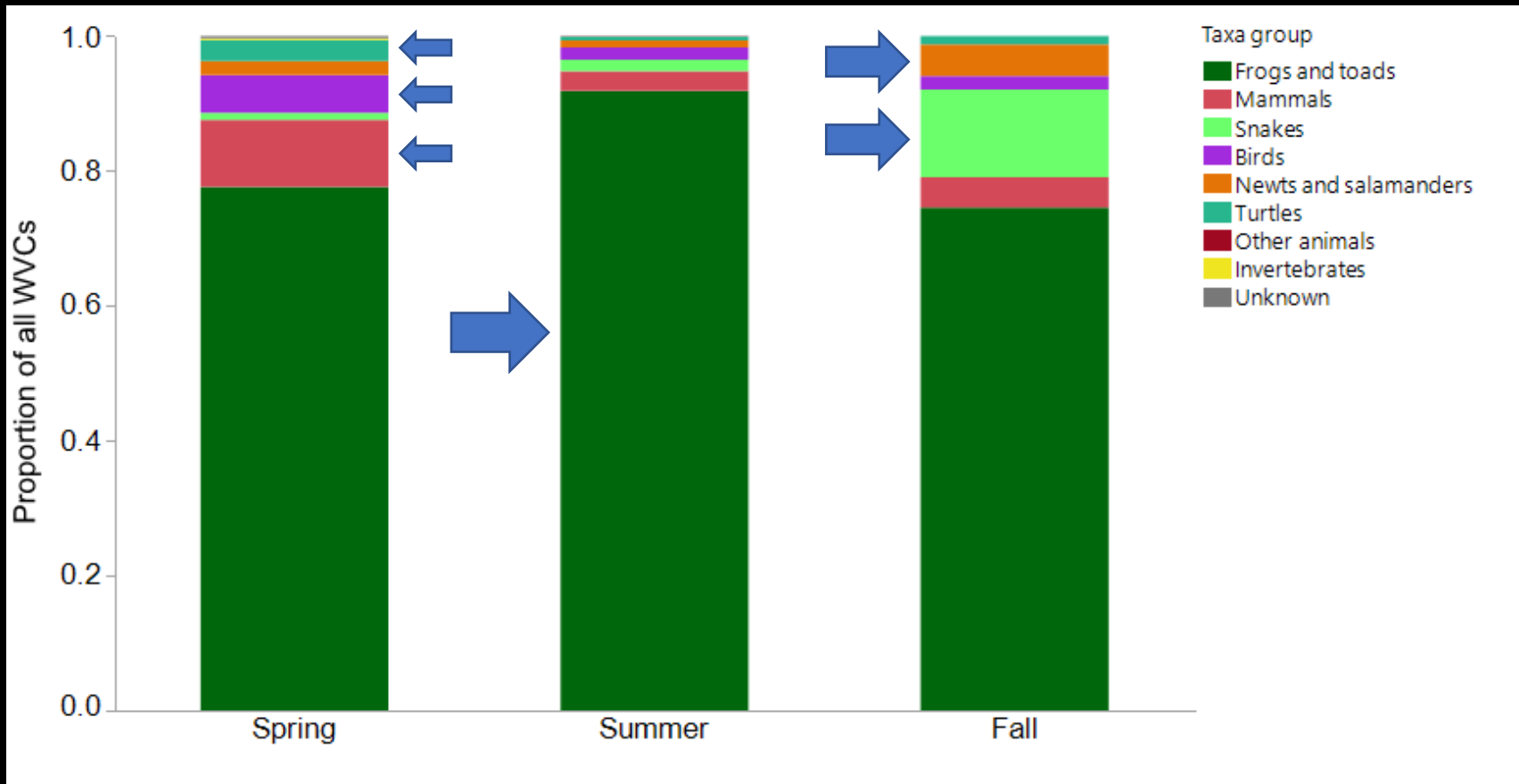


Common Snapping Turtle
(*Chelydra serpentina serpentina*)

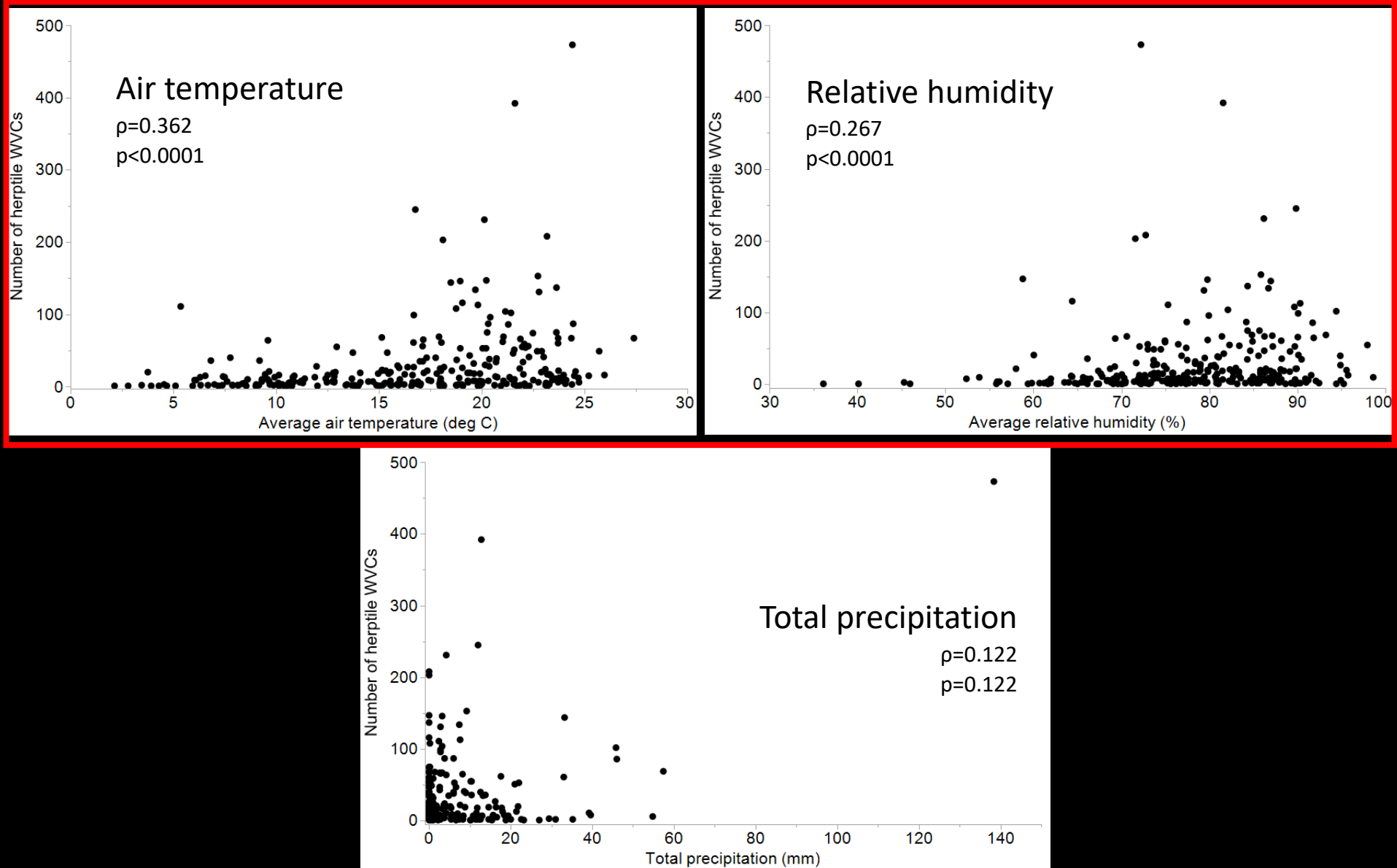
Species	L-rank	Total number of WVCs
Unknown		6075
American Toad	L4	588
Grey Treefrog	L2	338
Green Frog	L4	309
Northern Leopard Frog	L3	293
Spring Peeper	L2	176
Wood Frog	L2	173
Northern Red-bellied Snake	L3	132
Eastern Newt	L2	101
Eastern Gartersnake	L4	91
American Bullfrog	L2	56
Snapping Turtle (SAR)	L3	39
Midland Painted Turtle	L3	38
Jefferson Salamander (SAR)	L1	29
Grey Squirrel	L5	26
Raccoon	L5	25
Eastern Chipmunk	L4	24
Eastern Milksnake	L3	23
Pickerel Frog	L2	21
Eastern Cottontail	L4	20

Plus 59 more species...

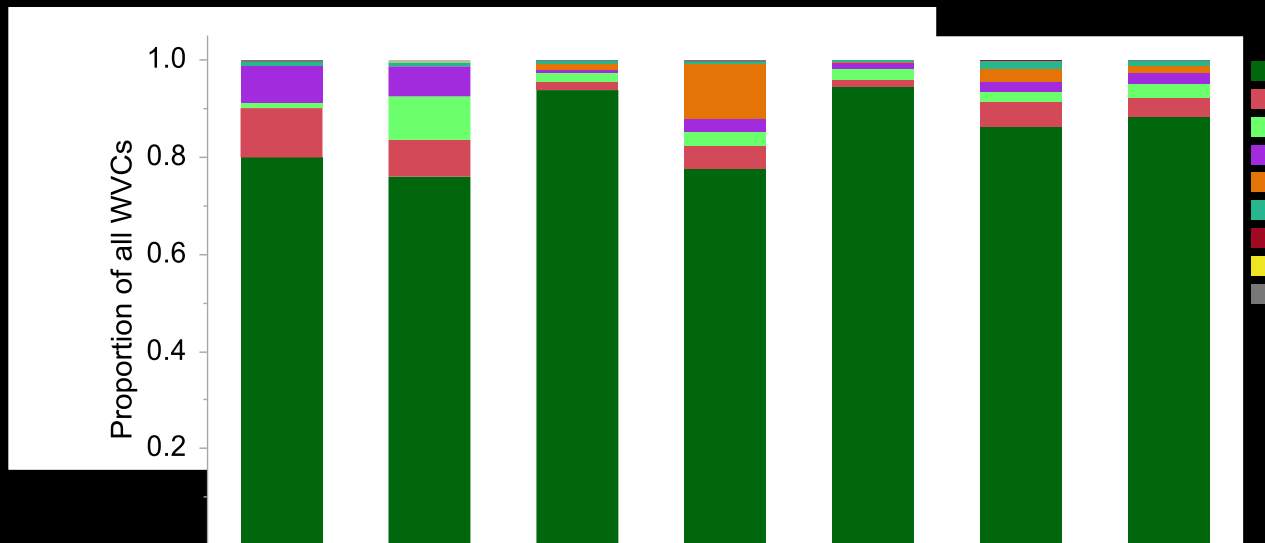
All sites combined – seasonal variation by taxa



Weather and herptile WVCs



Comparing among sites – composition by taxa group



- Sites are different... mitigation

Comparing among sites

- Prioritization/
mitigation

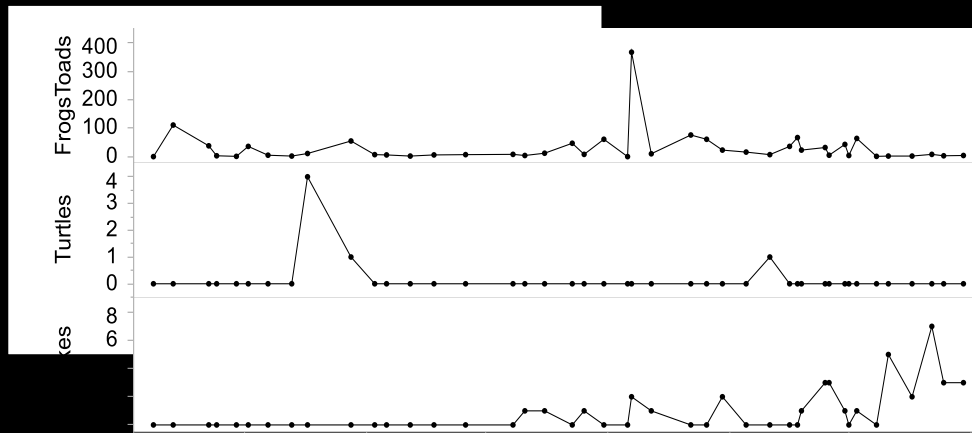


Pickerel Frog
(*Lithobates palustris*)

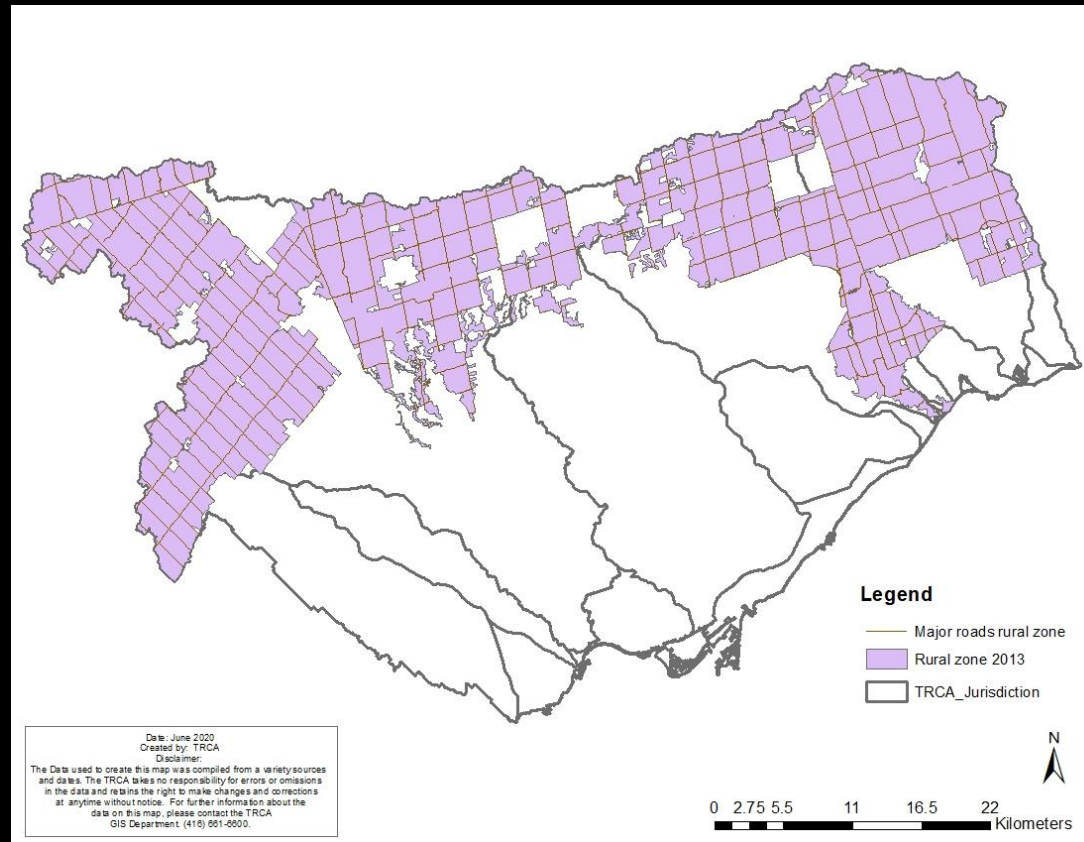
Species	L-rank	Airport	Goreway	Mountainview	Stouffville	Teston	The Gore	Total
Unknown		120	858	1748	186	1394	1769	6075
American Toad	L4	52	32	261	32	29	182	588
Grey Treefrog	L2	18		21	6	132	161	338
Green Frog	L4	17	17	158	8	29	80	309
Northern Leopard Frog	L3	29		155		61	48	293
Spring Peeper	L2			12	12	138	14	176
Wood Frog	L2	2	4	3	37	22	105	173
Northern Red-bellied Snake	L3		79	17	8	20	8	132
Eastern Newt	L2			29	6	1	65	101
Eastern Gartersnake	L4	3	14	27	1	14	32	91
American Bullfrog	L2			56				56
Snapping Turtle (SAR)	L3	2	2	8			27	39
Midland Painted Turtle	L3		6	6	1	6	19	38
Jefferson Salamander (SAR)	L1				29			29
Grey Squirrel	L5	3	6	2	1		14	26
Raccoon	L5		7	4	2	1	11	25
Eastern Chipmunk	L4			6		2	16	24
Eastern Milksnake	L3			4		9	10	23
Pickerel Frog	L2			1			20	21
Eastern Cottontail	L4	5	8	2			5	20
American Robin	L5		9		1	1	4	15
Porcupine	L2			1			13	14

Plus 57 more species...

Timing movements and mapping hot spots – e.g. Teston Road



We estimate that approximately 1.2 million wildlife-vehicle collisions occur in one season (April-November) on major roads in the rural area of the jurisdiction.



Conclusions

- WVCs are a major threat to wildlife population persistence
- The results of this project can be used to:
 - Guide where to install wildlife passages
 - What type of passage would have maximum benefit based on species
 - Restrict traffic
 - Raise awareness on the extent of the issue



Acknowledgements

- Sue Hayes, Will Brown, Dorian Pomezanski, Bridget Holmes, Chana Steinberg, Samantha Stefanoff, Caitlin Fortune, Chris Menary, Parth Sheth, Paul Prior, Dell Tune
- York Region, Peel Region



Making the Connection

The role of technology and habitat use in making good wildlife connectivity decisions.

Presented by: David Lawrie, Research Scientist

September 14, 2021

Heart Lake a long winding road to get here



Heart Lake Road



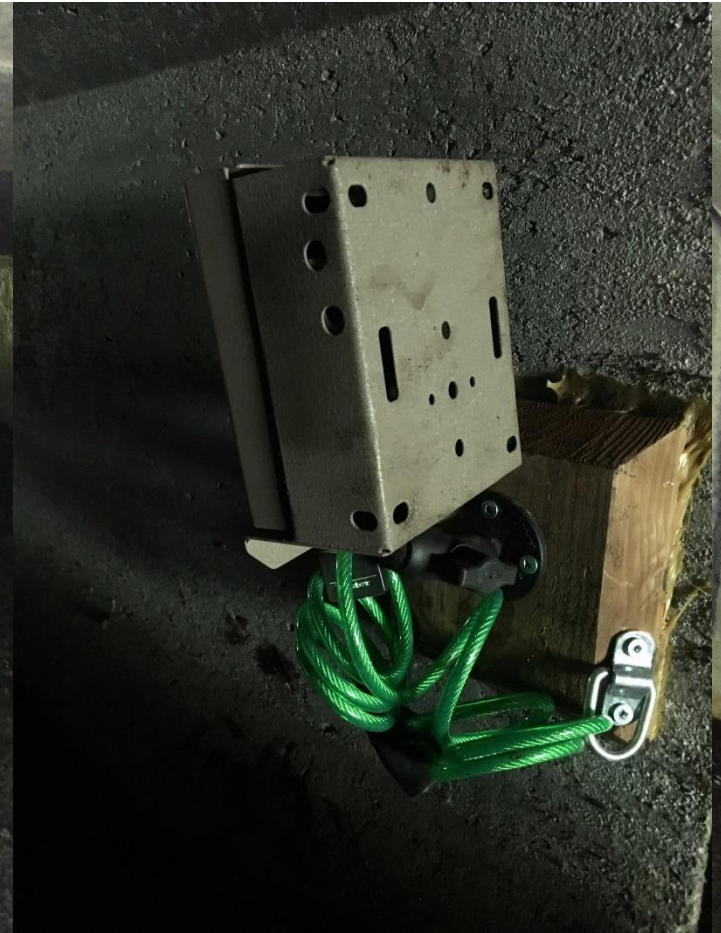
Heart Lake Road



A Snapshot of Mitigation



The 2m Box Culvert



Typical PIR Cameras vs HALT Laser Trigger

Camera Type	Bushnell Eastside Low Glow	Bushnell Liveview Laser Trigger	Bushnell Westside No Glow
Species Observed, L-Rank	Raccoon, L5	Raccoon, L5	Raccoon, L5
	Deer Mouse, L4	Deer Mouse, L4	Deer Mouse, L4
	Eastern Chipmunk, L4	Eastern Chipmunk, L4	Eastern Chipmunk, L4
	Eastern Cottontail, L4	Eastern Cottontail, L4	Eastern Cottontail, L4
	Grey Squirrel, L5	Grey Squirrel, L5	Grey Squirrel, L5
	Mink, L4	Mink, L4	Mink, L4
	Red Squirrel, L4	Red Squirrel, L4	Red Squirrel, L4
	Striped Skunk, L5	Striped Skunk, L5	Striped Skunk, L5
	Virginia opossum, L4	Virginia opossum, L4	Virginia opossum, L4
	Vole, L4	Vole, L4	Vole, L4
		Ermine, L3	
		American Toad, L4	
		Common Snapping Turtle, L3	
		Green Frog, L4	
		Milksnake, L3	
		Muskrat, L4	
		Northern Leopard Frog, L3	
		Shrew, L3	
Total of Species Captured	10	18	10
Total # of Detections	607	2274	794*

Considerations for Design & Implementation

City of Brampton Heart Lake Road ACO Wildlife Tunnel Installation – 2 Days





HALT Laser Trigger in ACO



ACO Movement Year 1 Results

June 30th - November 16th				
Camera Type	45cm (18") Halt Camera North Tunnel		45cm (18") Halt Camera South Tunnel	
	Species	L-Rank	Species	L-Rank
Species Observed, L-Rank	American Toad	L4	American Toad	L4
	Deer Mouse	L4	Deer Mouse	L4
	Eastern Chipmunk	L4	Eastern Chipmunk	L4
	Eastern Cottontail	L4	Eastern Cottontail	L4
	Eastern Garter Snake	L4	not observed	•
	Ermine	L3	not observed	•
	Green Frog	L4	Green Frog	L4
	not observed	•	Grey Squirrel	L5
	not observed	•	Meadow Jumping Mouse	L3
	Milksnake	L3	not observed	•
	not observed	•	Mink	L4
	not observed	•	Muskrat	L4
	Northern Leopard Frog	L3	Northern Leopard Frog	L3
	not observed	•	Norway Rat	LX
	Raccoon	L5	Raccoon	L5
	Snapping Turtle	L3	not observed	•
	Striped Skunk	L5	Striped Skunk	L5
	Virginia opossum	L4	Virginia opossum	L4
	Vole (sp. Undetermined)	L3	Vole (sp. Undetermined)	L3
	not observed	•	Wood Duck	L4
	Wood Frog	L2	not observed	•
Total of Species Captured	15		16	
Total # of Image Detections	935		1690	

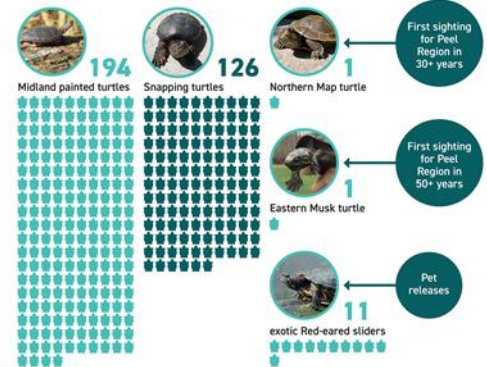


Tracking Turtle Movement



THE TURTLES OF THE HEART LAKE WETLAND COMPLEX

LOTS OF TURTLES!



ROAD SIDE NESTING



- Turtles nest along the road
- Nesting is dangerous to females
- Heart Lake road is dangerous to turtles

WHAT CAN WE DO?



Keep turtles away from the road with fencing and underground passages



Build nesting structures away from the road



Keep monitoring road mortality and nest sites

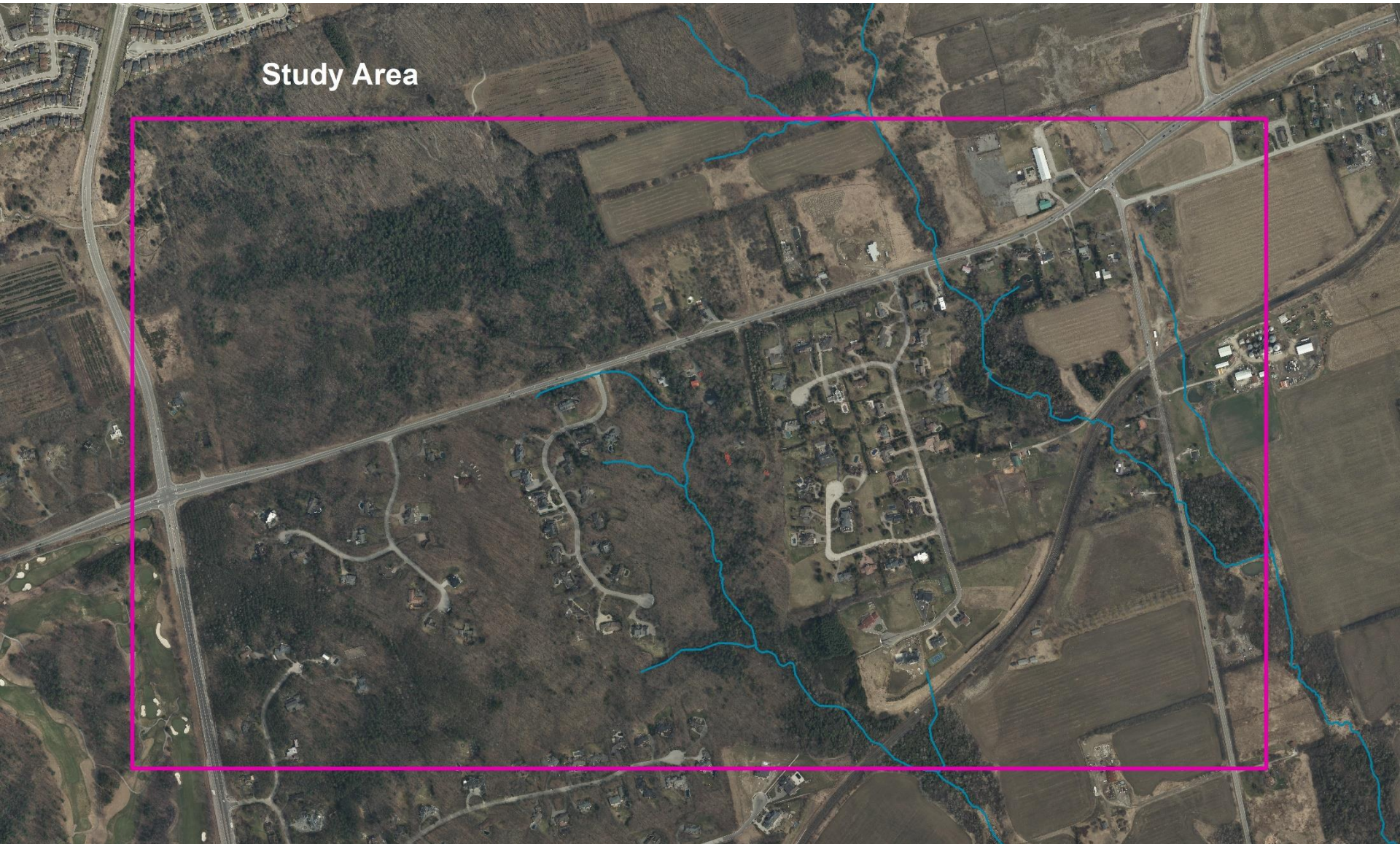


Have turtles in mind when developing the area

Tracking Turtle Movement



Stouffville Road



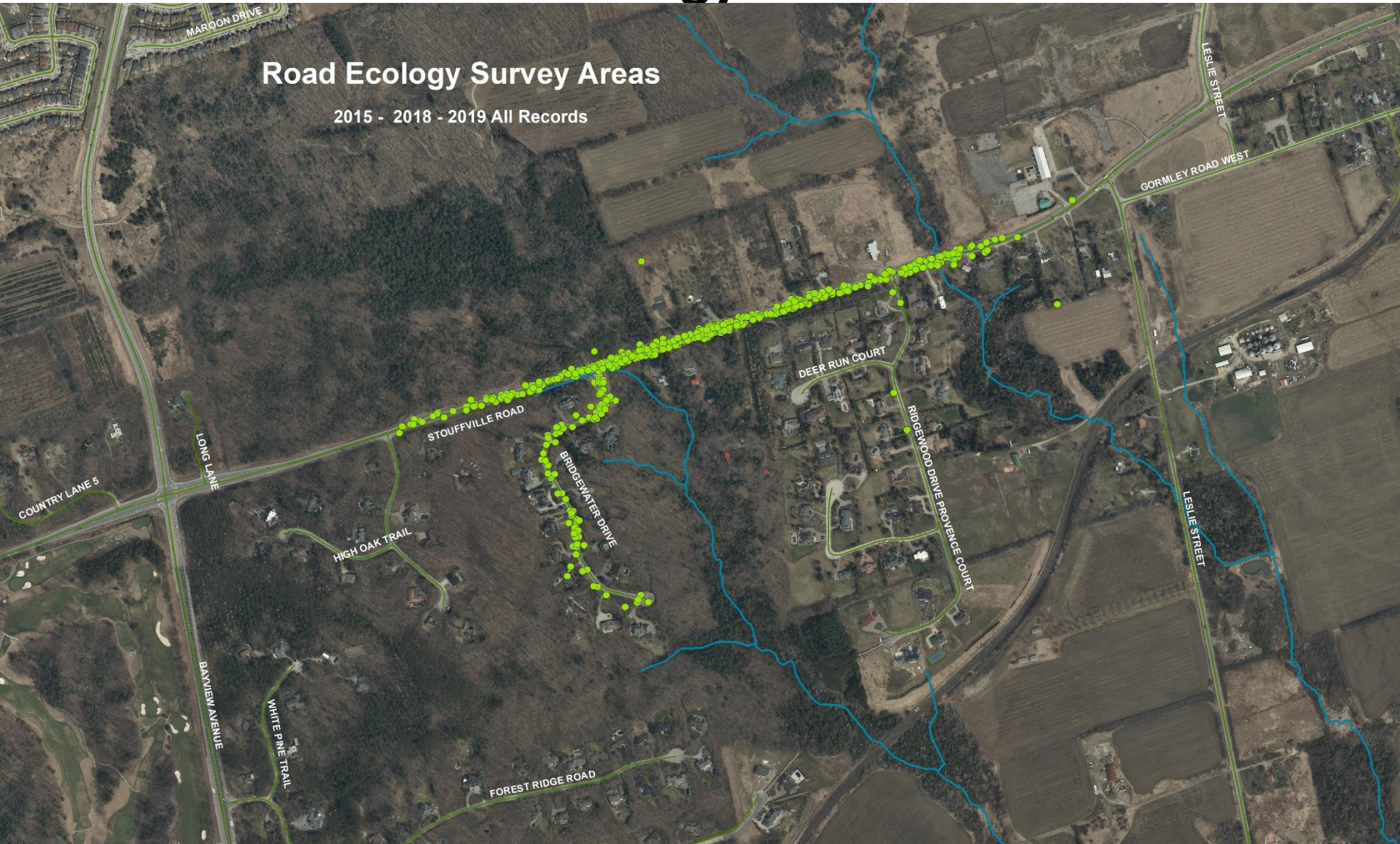
Stouffville Road



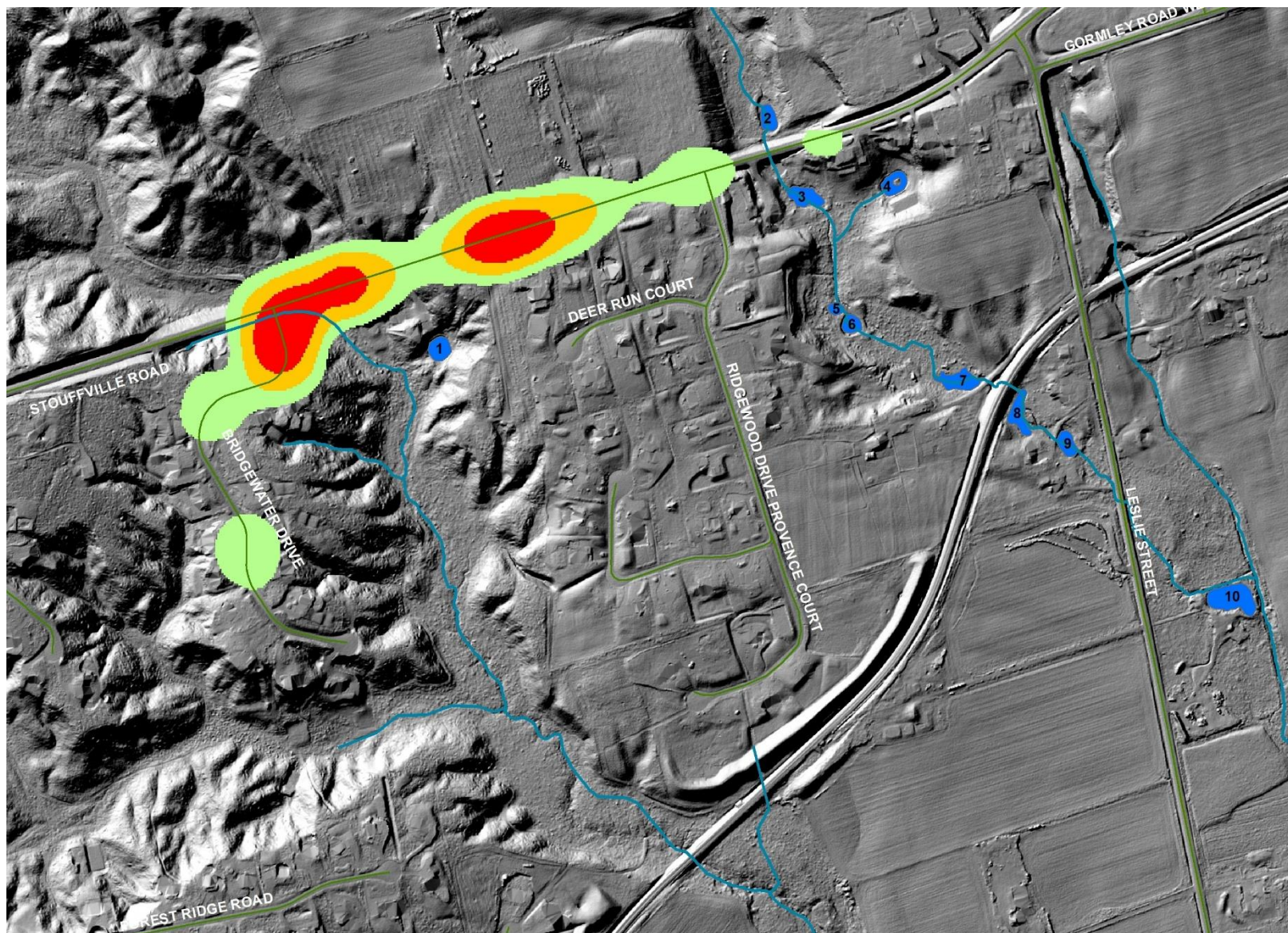
Total Road Ecology Faunal Records

Road Ecology Survey Areas

2015 - 2018 - 2019 All Records



Focal Movement Areas JESA



Understanding Timing of Movements



Stouffville Road

June 12 2020



June 3 2021



Stouffville Road

August 23 2020



August 30 2021



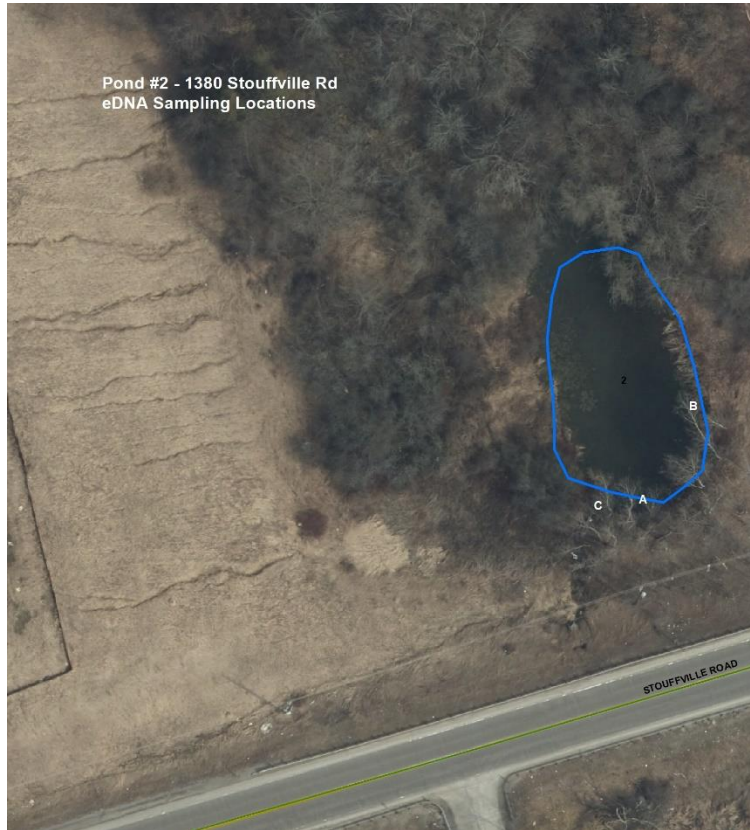
NRSI and UofG Partnership



Stouffville Road



eDNA



Stouffville Road



Thanks to our Partners

York Region

Peel Region

NRSI Consulting

Guelph University – Norris Lab

Staff at TRCA

Ontario Species at Risk Stewardship Program

Upcoming ECS Lunch and Learns!

Tuesday, October 26

11:00am-12:00pm

**Carruthers Creek
Watershed Plan**

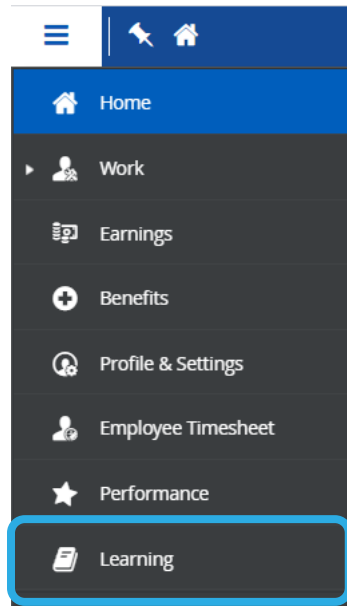
By Tony Morris


November - TBC

**National Issues Report
(2021): Water Resources**

By Guest Speakers

Learning Management System



 Course Catalog

CATEGORIES


FILTERS

Lunch and Learn

X

Q

4 items




New

Lunch and Learn: Teams, OneDrive and SharePoint

EN

Webinar




New

Lunch and Learn: Hobbies for Mental and Physical Health (Please read...

EN

ILT (Instructor-Led Training)




New

Lunch and Learn: Thermal Imaging for Restoration and Conservation

ENROLLED
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Webinar



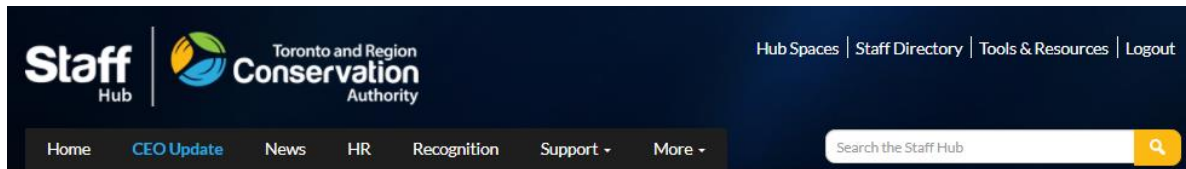
New

Lunch and Learn: Natural Heritage System Update

ENROLLED
EN

Webinar

Scientific Knowledge Sharing Hub



[Home](#) > [Scientific Knowledge Sharing](#)

Scientific Knowledge Sharing

Evidence-based decision making is at the core of what TRCA does. Several of our Business Units engage in generating new scientific knowledge to support watershed management actions and decisions.

It is critical that the knowledge generated is effectively shared.

The Scientific Knowledge Sharing platform is dedicated to sharing the latest scientific knowledge generated by TRCA and our partners. It is a place where staff can learn about and engage in the scientific work TRCA is undertaking.

PLEASE NOTE: There are several TRCA teams engaged in generating new scientific knowledge. Currently the content on the platform is specific to the Watershed Planning and Ecosystem Science business unit. Additional content from other TRCA teams will be added as the platform develops.



Knowledge Sharing: Learn More

- [Watershed and Ecosystems Reporting Hub](#)
- [Environmental Monitoring](#)
- [Research and Science Working Group](#)
- [TRCA Research Agenda](#)
- [Development and Engineering Services Hub Space](#)

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Knowledge Sharing: Latest Updates

[Knowledge Sharing - Climate Change Analysis at the Local Scale](#)

April 19, 2021 by Hub Admin [Featured](#)

....

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Past Recordings

Watersheds and Ecosystems Reporting Draft Web Application Laura Del Giudice, Senior Manager, Watershed Planning & Reporting Kristina Dokoska, Project Coordinator, Ontario Climate Consortium September 21, 2020	Introduction to the LID Treatment Train Tool <i>Presented by – Steve Auger, Sahila Abbasi and Yvonne David</i> November 5, 2020	TRCA's Recent Floodplain Mapping Updates Wilfred Ho*, Christina Bright*, Mike Todd** <small>* Flood Risk Management, Development & Engineering Services ** Information Technology & Records Management</small> November 10, 2020	Working with Indigenous Communities Lunch and Learn November 17, 2020
Green Infrastructure in Asset Management Planning Presented by: Michelle Sawka, Senior Research Scientist Tracy Timmins, Research Analyst Ecosystem and Climate Science December 8, 2020	Explore TRCA's Biodiversity How to get the most from our enormous natural heritage data set. Presented by: Gavin Miller, Flora Biologist, Paul Prior, Fauna Biologist, and Parth Sheth, GIS Technician. December 17, 2020	Evaluating the effectiveness of fish habitat restoration across the Toronto waterfront Kaylin Barnes ¹ , Lyndsay Cartwright ¹ , Rick Portiss ¹ , Jon Midwood ¹ , Christine Boston ² , Monica Granados ¹ , Thomas Sciscione ¹ , Colleen Gibson ¹ , Olusola Obembe ¹ ECS Lunch and Learn January 14, 2021 <small>¹ Toronto and Region Conservation Authority ² Fisheries and Oceans Canada ³ PIREview.org</small>	Erosion Risk Management Program Lunch and Learn Presentation Presented by: Matt Johnston, Associate Director Ashour Rehana, Manager David Gingerich, Analyst January 27, 2021
The Meadoway Research Overview The Meadoway COMMUNITY POWERED GREEN SPACES Presented by: TRCA	TRCA's Natural Heritage System Update Presented by: Namrata Shrivastha, Senior Research Scientist Andrew Chin, Research Analyst Ecosystem and Climate Science Watershed Planning and Ecosystem Science Development and Engineering Services 24 Mar 2021	Thermal imaging for ecosystem conservation and restoration Jonas Hamberg <small>Visiting Postdoctoral Fellow TRCA (ECS) & University of Toronto Advisors: Jonathan Ruppert & Patrick James (UofT)</small> <small>Credit: NASA/JPL</small>	Lake Ontario Fish and Aquatic Ecosystem Health <ul style="list-style-type: none"> Eat Safe Fish: A Collaborative Engagement with the Mississaugas of the Credit First Nation – by Valerie Francoella Don River Mouth Naturalization Project: Restoration of Fish Habitat in Toronto - The First Piece in a Very Large Puzzle – by Angela Wallace From Rivers Downstream to Lake Ontario: 20 years of aquatic sampling through The Regional Watershed Monitoring and Toronto Waterfront Monitoring Programs – by Jan Moryk and Angela Wallace
Lake Ontario Restoration Initiatives <ul style="list-style-type: none"> Determining Practical Key Performance Measures for Wetland Restoration Practitioners: Challenges and considerations – by John Stille RAP Delisting and the Adoption of the Integrated Restoration Prioritization Tool: Compiling TRCA data on waterfront and inland restoration planning and projects within the Toronto Area of Concern – by Andrew Ramesbottom and Colleen Gibson Winning the War One Battle at a Time: Managing phragmites and DSV at a Toronto waterfront park – by Jennifer Smith 	Precision Biomonitoring Webinar Series:  eDNA: Applications, Advantages and Implications! May 12, 2021	Lunch and Learn Wetlands, Warehouses or Both? – The Story of Project Lonerstar and the Lower Duffins Wetland Complex. Presented by: Steve Heuchert, Development Planning and Permits Shauna Fernandes Chagani, Planning Ecology	Long-Term Monitoring of Lake Ontario Coastal Wetlands Reveals Distinct Water Quality Profiles Associated with Hydrogeomorphic Type Kathryn Thomas ¹ , Krista Chomicki ² , Andrea Kirkwood ¹ <small>¹ Ontario Tech University ² Toronto and Region Conservation Authority</small>
Watershed and Ecosystems Reporting Hub Introduction and Demo of TRCA's New Reporting Hub Presented by: Shari Dahmer Project Manager, Watershed Planning & Reporting June 23, 2021	TRCA Water Resource System Methods and analysis for delineating Key Hydrologic Features & Areas Presented by: Jonathan Ruppert, Research Scientist, Ecosystem & Climate Science, WPES, DES July 14, 2021	BROADVIEW AND EASTERN FLOOD PROTECTION Municipal Class Environmental Assessment Project TRCA Lunch and Learn August 4 2021	Port Lands Flood Protection Enabling Infrastructure 2018-2023 Presented by: Maryam Iler Manager, PMO 2021 August 04

A photograph of a turtle crossing a road, with a car visible in the background. The image is overlaid with a blue tint.

Thank you

For questions about the ECS Lunch and Learn Series, please contact:

Sharon Lam
sharon.lam@trca.ca