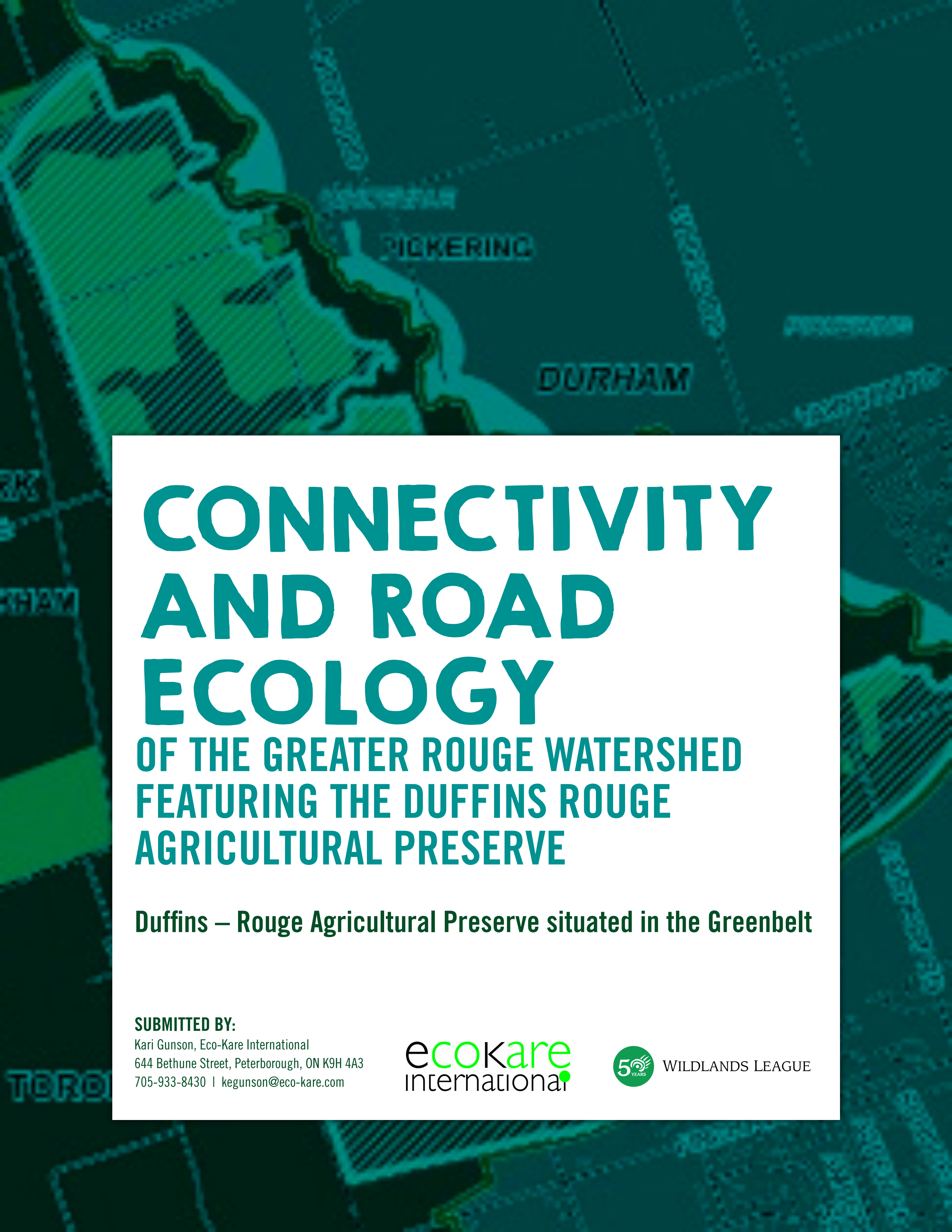

CONNECTIVITY AND ROAD ECOLOGY

OF THE GREATER ROUGE WATERSHED FEATURING THE DUFFINS ROUGE AGRICULTURAL PRESERVE

Duffins – Rouge Agricultural Preserve situated in the Greenbelt

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Wildlands League

CONTENTS

This report was commissioned and edited by Wildlands League and compiled by Kari Gunson. It is a living document and will be updated and edited as new information becomes available. It has not been peer reviewed and does not necessarily reflect the views of individuals and organizations named in the report. Any errors or omissions are the responsibility of the Wildlands League.

SUMMARY

This study area was conducted within the Greenbelt around Rouge National Urban Park in what was termed the Greater Rouge area. This area was defined as comprising the following watersheds as delineated by the Toronto Region Conservation Authority: Frenchman's Bay, Duffins Creek, Carruthers Creek, Rouge River and Petticoat Creek.

Research has shown that a frog's inability to avoid roads and their slow movement make them particularly vulnerable to road mortality, which likely explains the strong negative effects of roads on frog populations.

The Greater Rouge study area is primarily comprised of agricultural land (53%), followed by built-up residential area (25%) and about 13% forest and 4% wetland (Southern Ontario Land Resource Information System version 3.0). The study area is located among Urban Growth Nodes (UGN's – centres) scheduled for population growth and intensified development in Ontario's Places to Grow – Growth Plan for the Greater Golden Horseshoe Area 2006.

The Duffins Rouge Agricultural Preserve Act has recently been repealed by the Ontario Government with Bill 39. In addition, the Agricultural Preserve (DRAP) has been proposed to be removed from the Greenbelt designation subjecting the preserve to the threat of urbanization, including roads.

The DRAP is ideal to demonstrate the importance of preserving 'stepping stones' of natural habitat for connecting wildlife on a regional scale in the study area. There is a growing body of evidence that highlights the importance of small patches of natural habitat to prevent biodiversity loss (Herrera et al. and Saura et al. 2014). For example, a review conducted by Riva and Fahrig (2022) stresses that small natural habitats such as wood-lots, wetlands, and hedgerows play a disproportionate role in biodiversity conservation, especially in human-dominated regions, where the remaining natural habitat is scarce and occurs mainly in small patches. Small patches as stepping stones are important for wildlife dispersal and can help mitigate species range shifts due to climate change (Hilty et al. 2020).

BACKGROUND INFORMATION

Road ecology evaluates the interactions of roads with the environment. There are two primary impacts of roads on wildlife. First animals are killed by vehicles on roads while crossing a road. Secondly, when animals are reluctant to move across roads, roads become a barrier for movement and animals cannot access resources. This is commonly referred to as fragmentation or loss of connectivity.

Therefore, road ecology is a multidisciplinary science that integrates connectivity and road ecology science. Connectivity of natural habitat that includes water (wetlands and rivers) and other natural habitat such as forests and meadows are important to maintain. Building roads and other developments associated with roads should be planned for away from established core and corridor habitat. When roads do bisect core and corridor habitat, mitigation solutions such as crossing structures for wildlife are recommended.

Vehicular use and wildlife road-kill are positively correlated to each other. However, this phenomenon may eventually plateau when the number of vehicles reaches a threshold that deters wildlife crossing attempts, or when wildlife populations are eventually depleted near roads (Eberhart et al. 2013). Wildlife populations become depleted when sustained road-kill occurs and/or animals cannot cross roads to access essential resources.

In southern Ontario the total length of major roads has increased fivefold between 1935 and 1995 (Fenech et al. 2005) and continues to increase in the Greater Toronto area at a rapid pace. In 2010 there was no point in southern Ontario (excluding large lakes and protected areas) that is more than 1.5 km from a road. Simulation modelling has shown that the probability of wildlife population survival decreases with increasing road density (in the simulation they call it mesh density). If you think of roads criss-crossing a particular area, the more roads there are in that area, the higher the road 'density'. The more roads, the more obstacles for animals to cross and the more likely they will be killed by vehicles. Eventually the population will crash when a high enough road density is reached and local populations become extirpated (Figure 1).

There are thresholds in the effects of landscape fragmentation on the viability of wildlife populations (Hanski and Ovaskainen, 2002; Jaeger and Holderegger, 2005; Jaeger et al., 2006). Various studies about the effects of landscape fragmentation on biodiversity have been conducted on a smaller scale, e.g. for European badger (Meles meles), fox (Vulpes vulpes), roe deer (Capreolus capreolus) and wild boar (Sus scrofa) in Hesse, Germany, by Roedenbeck and Köhler (2006), and for brown hare (Lepus europaeus) in Aargau Canton, Switzerland, by Roedenbeck and Voser (2008). Several studies reported values of road density above which certain species do not occur any more. See below:

- Mech et al., 1988 for wolves (Canis lupus) in Minnesota,
- Kohn et al. 1986 2001 for wolves in Great Lakes Region,
- Mace et al. 1996 for grizzly bears (Ursus arctos horribilis) in Montana, reviewed by Switalski, 2006; Fahrig and Rytwinski, 2009; Robinson et al., 2010

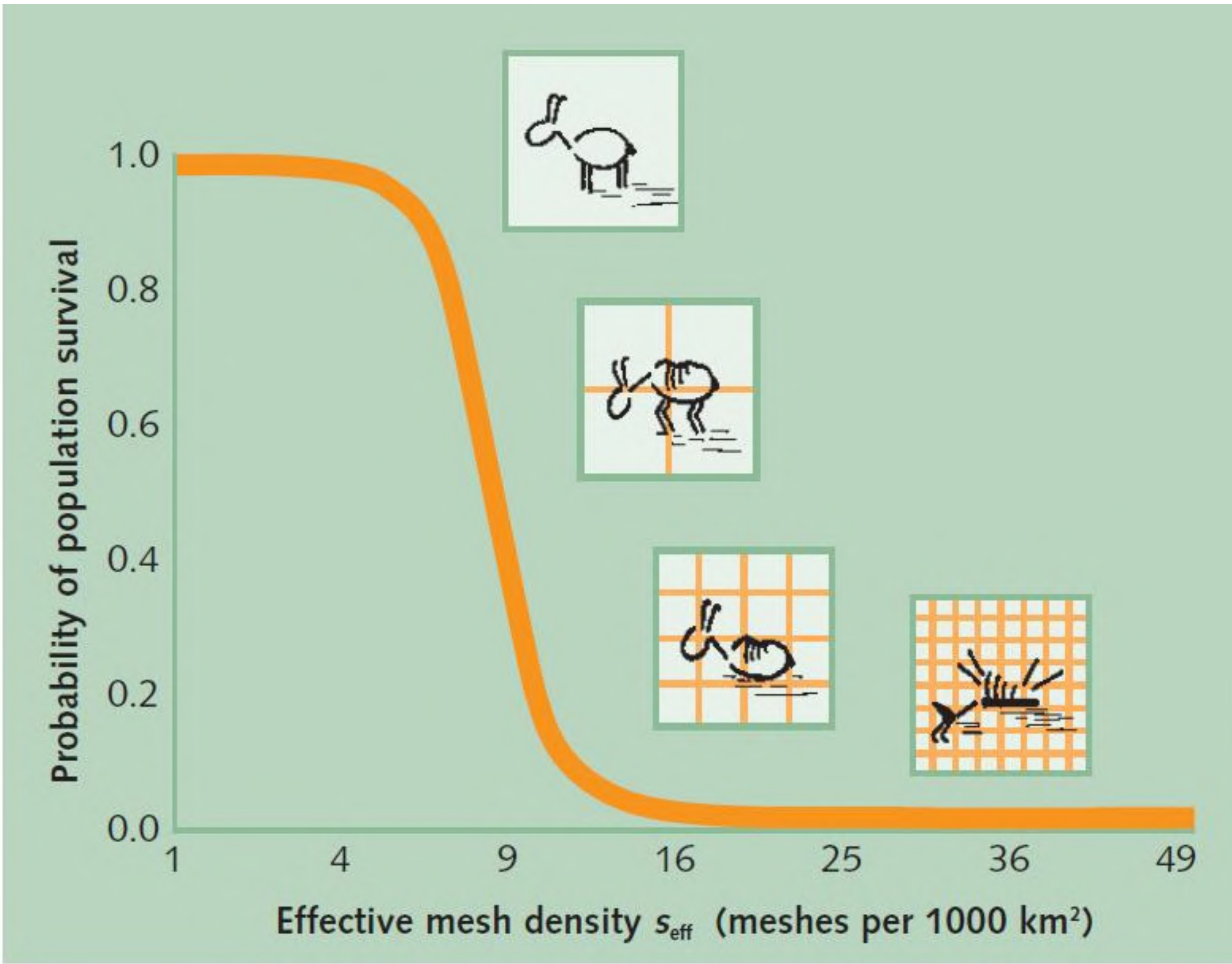


Figure 1. The degree of landscape fragmentation can be measured using effective mesh density on the x – axis (Jaeger & Holderegger 2005), and as mesh density increases the probability of population survival decreases until a local extirpation occurs.

As of 2022, there were 820 Species at risk (SAR) in Canada with 21 extirpated and 23 species extinct (Environment Canada 2022). and Ontario logs over 240 species at risk according to Ontario Nature, one of the highest percentage of species at risk among the provinces. Today, the negative impacts of roads are widely seen as a contributing factor leading to SAR designation. For example, all of Ontario's eight freshwater turtle species are listed as SAR under the federal Species at Risk Act, and roads have been identified as one of the most significant threats for five of these species (Seburn, 2007).

CORE AND CONNECTIVITY MAPPING

Broader Study area

The study area is within the Greenbelt boundary defined as the Greater Rouge area comprising the following watersheds: Frenchman's Bay, Duffins Creek, Carruthers Creek, Rouge River and Petticoat Creek as delineated by the Toronto Region Conservation Authority. There are three primary property boundaries within the Greater Rouge area: Rouge Urban National Park (RUNP) managed by Parks Canada, Duffins-Rouge Agricultural Preserve (DRAP) formerly protected under the Duffins Rouge Agricultural Preserve Act and contained within the Greenbelt, and the Pickering Airport Lands currently managed by Transport Canada. The boundaries of the Airport Lands and DRAP are within the City of Pickering and RUNP is within the City of Markham boundary.

The Greater Rouge study area is primarily comprised of agricultural land (53%), followed by built-up residential area (25%) and about 13% forest and 4% wetland (Southern Ontario Land Resource Information System version 3.0). The study area is located among Urban Growth Nodes (UGN's – centres) scheduled for population growth and intensified development in Ontario's Places to Grow – Growth Plan for the Greater Golden Horseshoe Area 2006

The Duffins Rouge Agricultural Preserve Act has recently been repealed by the Ontario Government with Bill 39. In addition, DRAP has been proposed to be removed from the Greenbelt designation subjecting the preserve to the threat of urbanization. The nearly 4,700 acres of prime agricultural land is situated between the Duffins Creek watershed and Rouge Urban National Park and is an important corridor for movement of wildlife and water. The preserve also contains pristine natural habitat that provides refuge for many wildlife species.

The Pickering Airport Lands (75 km^2, 18,600 acres) of land has been owned by the Government of Canada since 1972. About 10,000 acres was transferred to Parks Canada Agency, and currently the remainder of the land is primarily being used for agricultural purposes.

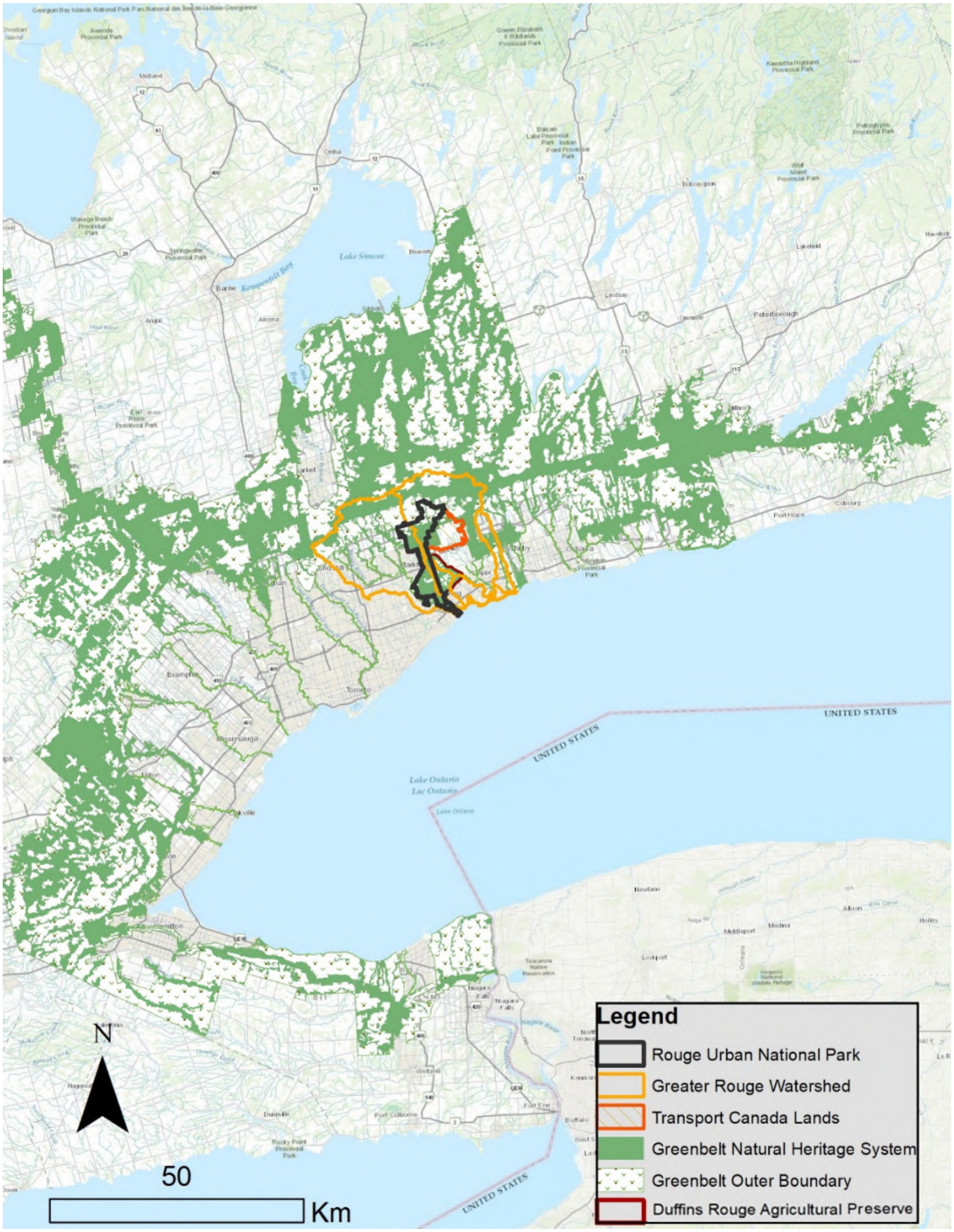


Figure 2: Greater Rouge Watershed within the larger Greenbelt area with the Natural Heritage System

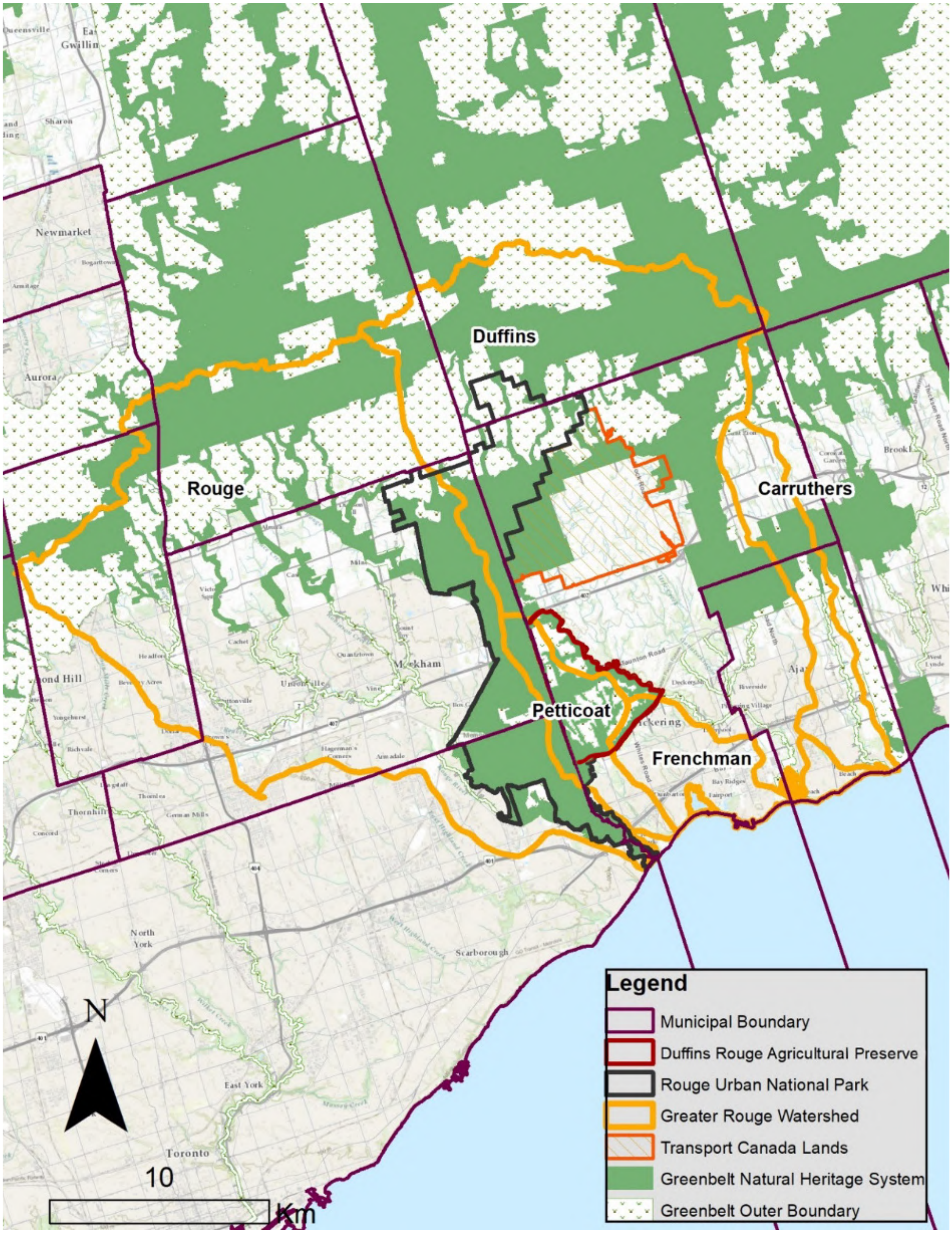


Figure 3: Greater Rouge study area comprised of Rouge River, Carruthers, Petticoat, and Duffins Creeks' watersheds

Scope

We held several expert meetings (June 3rd, 2022; July 5th, 2022) to define the specific components of the study (Figure 3). In attendance at the meetings were: Marie-Josée Fortin (University of Toronto) Peter Rodriguez (University of Toronto), Megan Sipos, Namrata Shrestha (TRCA), Julia Phillips (Parks Canada, Rouge National Urban Park), Thomas Bowers, Kari Gunson (EcoKare International), and Dave Pearce (Wildlands League) attended. We had a follow-up meeting with Namrata Shrestha and David Lowry, research scientists, TRCA on November 24th, 2022, about available wildlife and fauna data in the study area.

We defined our inputs for the assignment (Figure 4). Namely the study area, objectives and target species. We also obtained an understanding of other agency efforts in the study area to ascertain what data was available and how these data contributed to landscape level movements across the landscape.

Available data sets included several natural heritage systems, wetland-forest local connectivity mapping, and Circuitscape regional connectivity mapping completed by the Toronto Region Conservation Authority. The natural heritage system has recently been accepted as a public document (TRCA 2022). The wetland-forest local connectivity mapping is based on parameters defined by analysing long term presence/absence of amphibian species at wetlands within the TRCA watershed in collaboration with K. Gunson of Eco-Kare International in 2011. The results of this mapping showed that more amphibians are present in wetlands that have approximately 40% forest cover surrounding 400 m of a wetland.

Amphibian species that occur in the study area listed alphabetically are the American bullfrog, American toad, Eastern Red-backed salamander, Gray treefrog, Green frog, Northern Leopard frog, Spotted salamander, Spring peeper, Western Chorus frog, and Wood frog. There are also a few observations of Jefferson salamanders and Mink frogs (TRCA fauna observations, 2011; iNaturalist download, December 2022). Freshwater turtles that occur in the study area are Snapping Turtles, Painted Turtles and possibly Blanding’s Turtles.

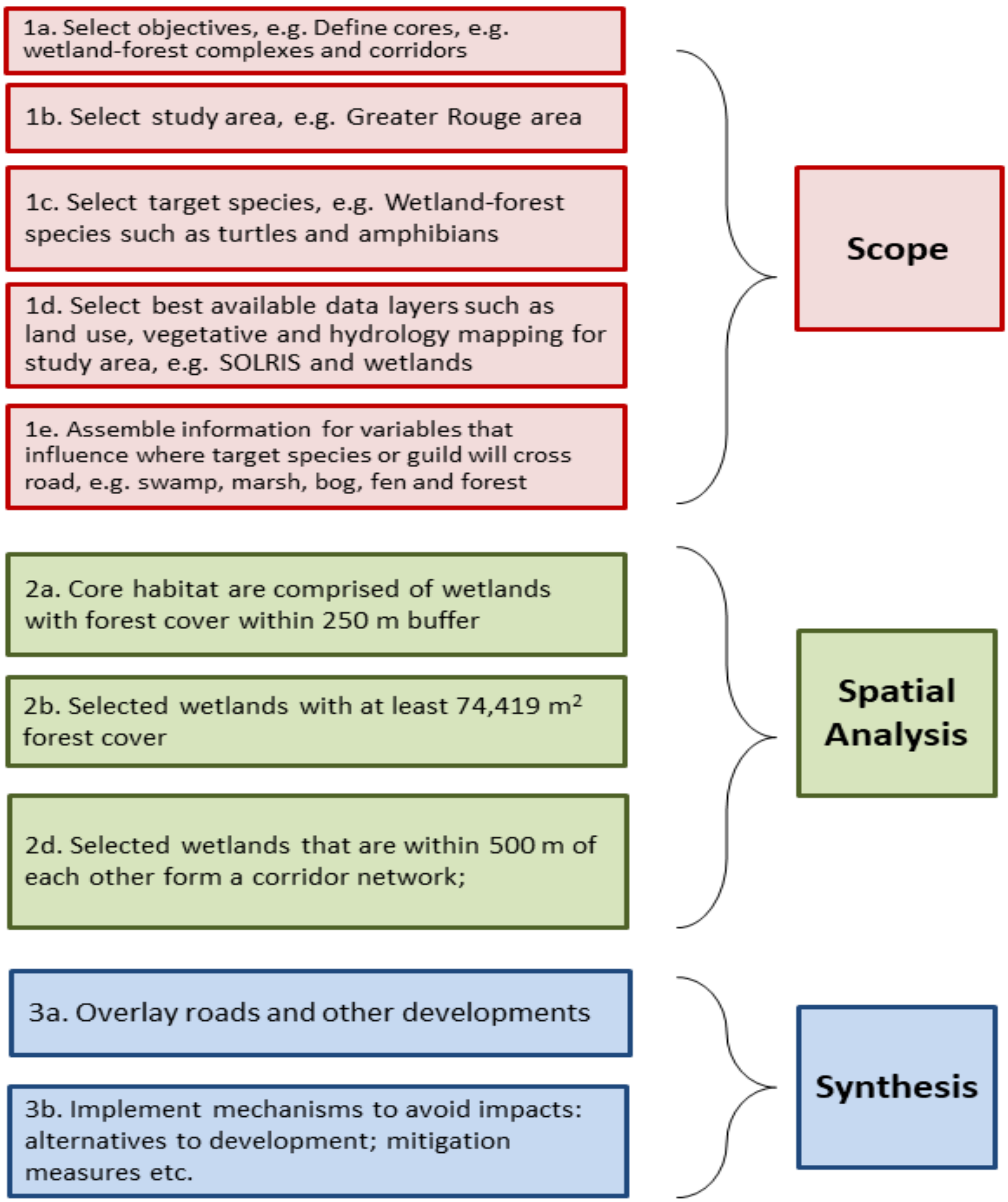


Figure 4: An overview of geospatial mapping used to depict road segments prioritized for road ecology mitigation solutions in the Greater Rouge Park study area.

Objectives

The primary objective is to define core and corridor areas within the context of the Greater Rouge study area and to overlay roads and other proposed developments to assess impacts and find opportunities for mitigation in response to proposed new roads, housing and other infrastructure.

Duffins Rouge Agricultural Preserve (DRAP) Case Study

In response to removing the Duffins Rouge Agricultural Preserve (DRAP) from the Greenbelt and repealing the Duffins Rouge Agricultural Preserve Act by the Ontario Government in October 2022, we selected this area to focus on for our initial core and connectivity mapping in the Greater Rouge watershed.

The DRAP is ideal to demonstrate the importance of preserving 'stepping stones' of natural habitat for connecting wildlife on a regional scale in the study area. There is a growing body of evidence that highlights the importance of small patches of natural habitat to prevent biodiversity loss (Herrera et al. and Saura et al. 2014). For example, a review conducted by Riva and Fahrig (2022) stresses that small natural habitats such as wood-lots, wetlands, and hedgerows play a disproportionate role in biodiversity conservation, especially in human-dominated regions, where the remaining natural habitat is scarce and occurs mainly in small patches. Small patches as stepping stones are important for wildlife dispersal and can help mitigate species range shifts due to climate change (Hilty et al. 2020).

This area is also ideal to demonstrate the importance of the preserve in providing east-west habitat connectivity between the Duffins and Rouge riparian ecosystems that provide north-south linkages between the Greenbelt and Lake Ontario. The DRAP is nestled between Duffins Creek and Rouge Urban National Park.

We selected freshwater turtles, primarily Blanding's Turtles as our focal species for habitat mapping. Blanding's Turtles are an ideal umbrella species because these turtles tend to use a complex of wetlands over large areas that other turtles and wetland-forest amphibians use as well (Grgurovic & Sievert 2005). There is also existing data and science on landscape level connectivity needs and movements for these animals.

Research has shown that Blanding's turtles prefer wetlands that are farther away from roads and that have more surrounding forest (Attum et al. 2008). Attum et al. (2008) showed that Blanding's turtles are more likely to occur in wetlands with more forest cover within 250 m. This distance is also ideal for the amphibian turtle assemblage because Semlitsch and Bodie (2003) found core terrestrial habitat ranges from 159 to 290 m for amphibians and from 127 to 289 m for reptiles from the edge of the aquatic site.

WE SELECTED THE FOLLOWING RULES FOR MAPPING CORE HABITAT RELATED TO BLANDING'S TURTLES:

1 We buffered each wetland by 250 m within the Greater Rouge study area

2 The amount of forest cover was calculated for each buffered wetland and an average was calculated for wetlands with forest cover

3 Wetlands with forest cover proportions above the average (74,419 m2) were selected as preferred wetlands

4 The majority of Blanding's Turtle inter-wetland movements (81%) were less than 500 m in length in Algonquin Provincial Park (Edge at al. 2010).

- Amphibian species generally move about 1 km (Patrick et al. 2012)
- Preferred wetlands were buffered 500 m radius to display 500 m movement corridor area away from wetlands
- Wetlands that are within 500 m of each other are connected as a potential wetland-forest complex corridor (yellow shading, Figure 5) for a Blanding's Turtle population
- Animals may move between yellow core habitat during dispersal events

In DRAP there are two key east-west wetland complexes. A treed swamp complex – labelled 1 that is hydraulically connected southerly to the Townline swamp provincially significant wetland complex near Finch Avenue – labelled 2. Both these complexes are essential 'stepping stone' for wildlife moving between Duffins and Rouge Creek natural riparian systems (Figure 5). The wetland-forest habitat patches along the orange line or wildlife corridor are less than 2 km apart and are therefore adequate distance for movement of some species of snakes, amphibians and turtles.

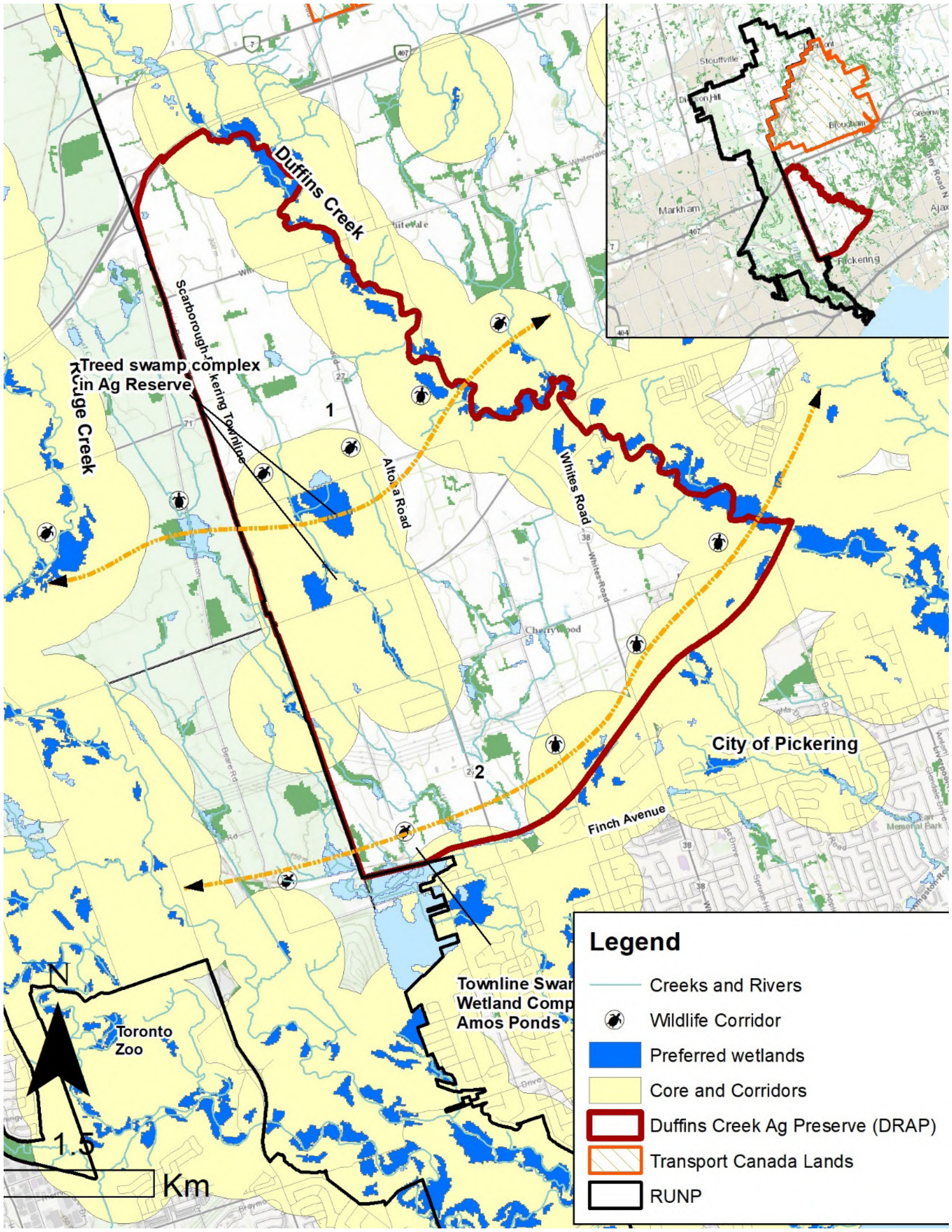


Figure 5: Core and corridor network (yellow shaded) areas where wetland-forest animals such as turtles and amphibians will move within to access resources. Note the lighter blue wetlands are also important stepping stones, although not preferred habitat due to lack of forest cover.

If these patches and its surrounding agricultural land use were modified with residential infrastructure, urban sprawl will increase, and animals will no longer be able to move safely between east and west from Rouge Creek to Duffins Creek (Figure 6). In addition, this loss of connectivity reduces the ecological integrity of RUNP that is currently undergoing restoration to provide habitat for wildlife. Figure 6 below shows the proposed housing in the City of Pickering 2004 Official Plan would be distributed in relation to the core natural habitat and east-west corridors.

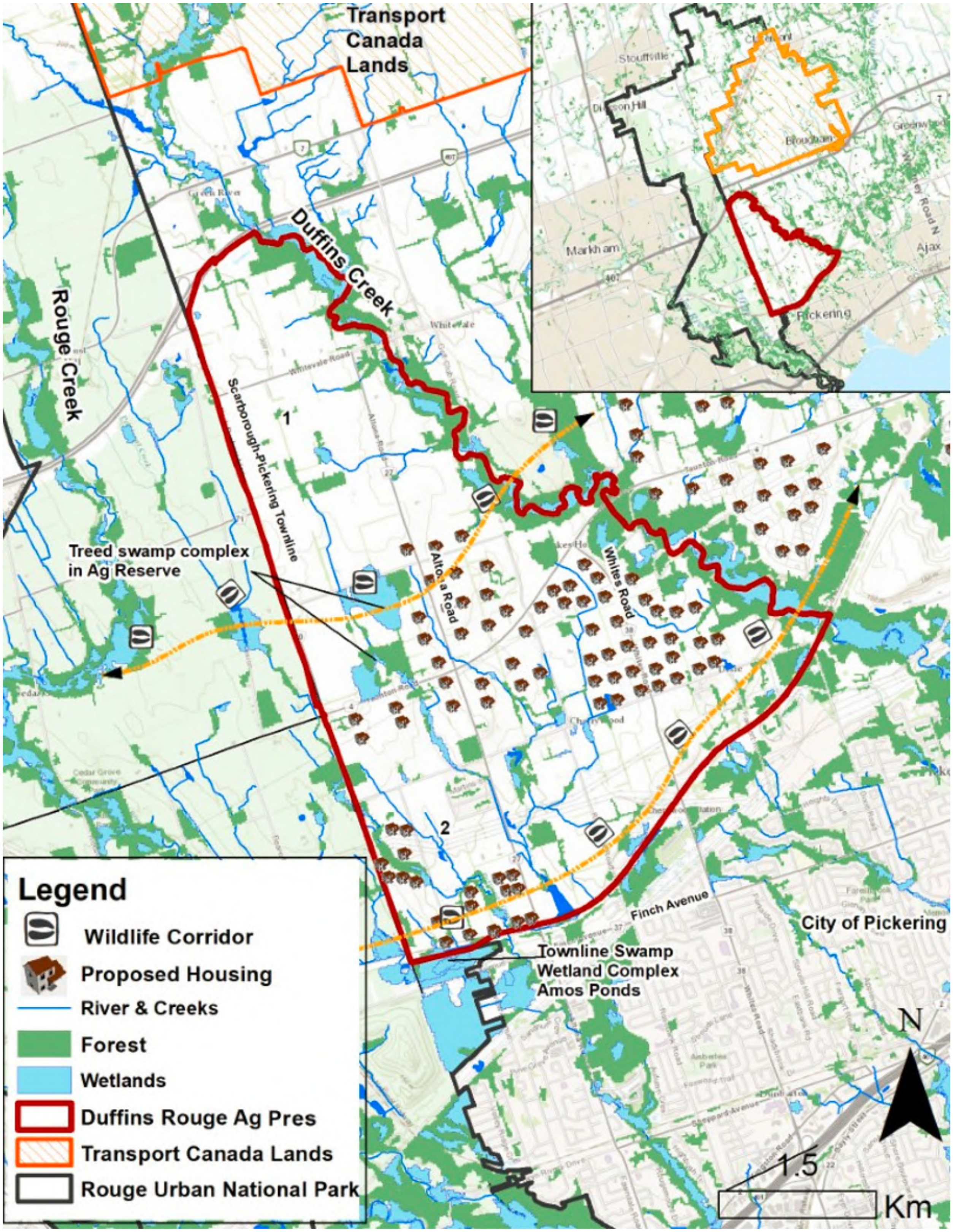


Figure 6: Map showing where urban residential areas (as depicted in the 2004 City of Pickering Official Plan) have previously been proposed within DRAP.

Agricultural land is a much more suitable mosaic of land use surrounding natural habitat than urbanized land, because it provides a morepervious substrate for hydraulic flow Furthermore, wildlife species are able to move through agricultural landscapes to access sources of natural habitat that are more often than not isololated across Southern Ontario's landscapes. Road development and human habitation is minimized in agricultural landscapes compared to urbanized ones.

The loss of DRAP as a buffer and stepping stone for migration and dispersal of wildlife and water will have negative impacts on the natural living communities and in some cases wildlife populations may be extirpated. This will also diminish neighbouring wildlife populations in surrounding areas because there will no longer be recruitment of individuals from the preserve and these populations will be increasingly isolated and unable to move to and between intact natural habitat.

Other impacts of sprawl include the elevated impacts of road networks in their physical footprint and traffic volume when servicing new housing subdivisions remote from transit options. Increased traffic on roads will directly increase the probability of animals being road-killed (Appendix A). No development in the DRAP is the primary and best solution to reduce impacts to wildlife and overall biodiversity while mainaining the lands as prime agricultural habitat.

FIELD TRIP

On July 4th, 2022 Kari met with Dave Pearce and we visited several stream crossing locations near the Transport Airport Lands (labelled in Figure below). The objective of the field trip was to understand the potential road mortality threat for wildlife. For example, we scanned the roads for any road mortality, and observed the road surface condition, number of vehicles, lanes etc.

There was full sun and warm temperatures above 20 degrees and we did not observe any road mortality that day. The regional roads were paved and Annual Average Traffic Volumes (AADTV) range from 2,000 vehicles on Concession roads to 20,000 vehicles on commuter roads such as Taunton Road (Region of Durham, unpublished data 2019). The local roads were primarily gravel or dirt two lane roads with minimal traffic assumed to be less than 2,000 vehicles daily.

In Appendix A there is a chart that looks at the probability of a frog being killed when crossing roads as a function of traffic volume. The existing traffic volumes on the local roads likely do not pose a road mortality threat in their current condition, however this should be confirmed during amphibian or snake migrations because higher traffic volumes may coincide with when animals are on the road. This needs to be assessed in early spring (amphibians) and during warm days in the fall September and October (snakes). Mitigation strategies can include educating the local community and setting up crossing guards and/or warning signage when and where these road mortality hotspots occur.

Many of the riparian-bridge interfaces could be modified for wildlife passage and this should be accommodated as bridge replacements occur. The clearance between the riparian passage and road should be at least 4 m for deer passage. The span of the bridge should allow for high water flow as well as terrestrial berm pathways along the riparian corridor. The pathways should be made from a soft substrate such as dirt or sand and the largest rock used should be pea gravel. Rip rap (broken rock) should be avoided at the entrance to the structure. Funnel fencing is required to guide animals into the structure. Debris piles, and cover boards can be used for smaller animals to secure cover and provide safe refuge for prey species and or animals seeking shade etc.

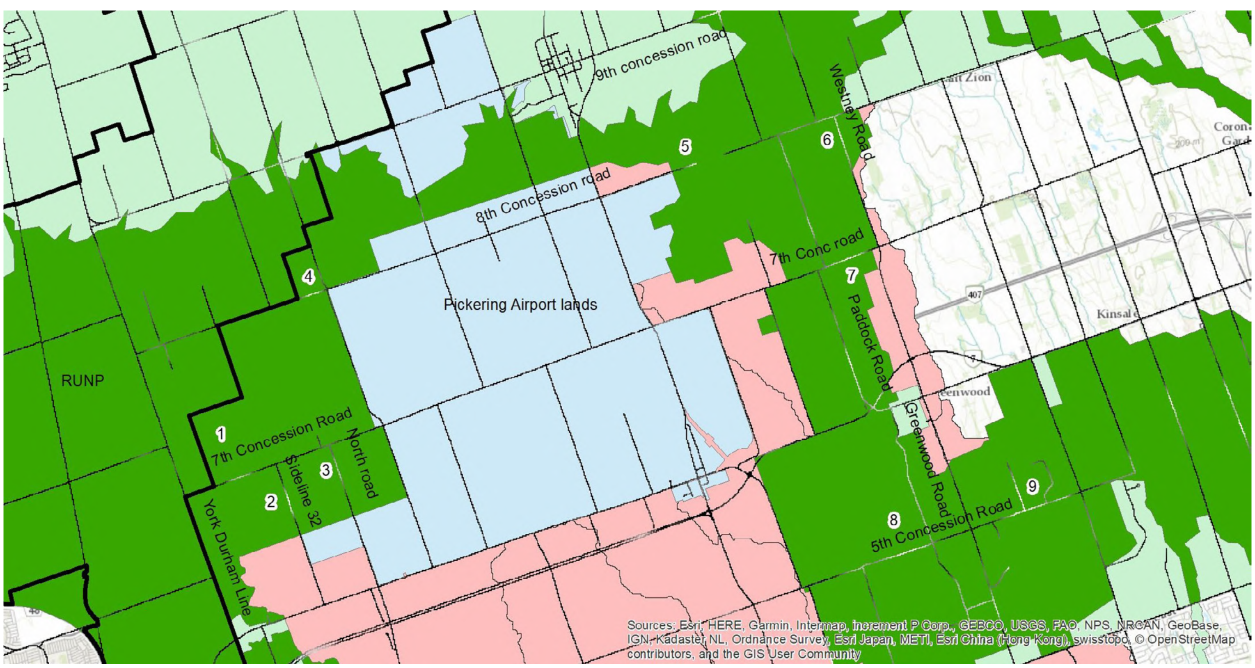


Figure 7: Numbered locations where roads crossed streams and creeks that were visited during our field trip

Site 1: 7th Concession and Sideline 32 with wing walls that are ideal for tying in wildlife funnel barrier to the structure.

Site 1: Looking underneath a bridge structure, concrete is deteriorating and will likely be replaced in near future. This is a good example of an opportunity to provide additional clearance for increased flooding that comes with climate change as well as ecopassages for species. Raised terrestrial riparian pathways like the sandy river bank here are also needed in many cases. Bobcat tracks were observed here in the sand.

Ecopassages also require exclusion fencing to keep animals off the roads and guide them to bridges or other crossing structures.

Looking at a riparian crossing from stream level. Clearance is adequate but requires a level terrestrial pathway at grade or slightly higher than water levels for wildlife passage.

Looking down at a riparian crossing from the road.

Site 6: Westney and Concession road 8; mud berm along riparian pathway for wildlife passage.
A wider pathway would be preferred.

Site 6: Riparian pathway at site 6: Westney and Concession Road 8.


WORKSHOP

As part of this project a workshop and field excursion took place on October 6h, 2022.

During the field excursion we visited a verified snake mortality hotspot at Rouge creek and Reesor road and discussed mitigation solutions at the stream crossing to deter snakes from moving up onto the road. It would be valued addition information to understand why the snakes are moving onto the road, e.g. whether to cross or thermoregulate to be able to design an effective solution. We suggest observing snake behaviour on the warm days during September and October. The crossing rates and movements can be recorded

There is an existing natural sand berm above water levels at the site. Cover boards, plastic pipe, rocks, and debris piles are proposed as items to add to the terrestrial berm to encourage snakes to utilize the natural habitat below the road. Snakes and other cold-blooded animals are sensitive to colder temperatures when moving under roads, therefore objects that provide warmth similar to road asphalt are ideal.

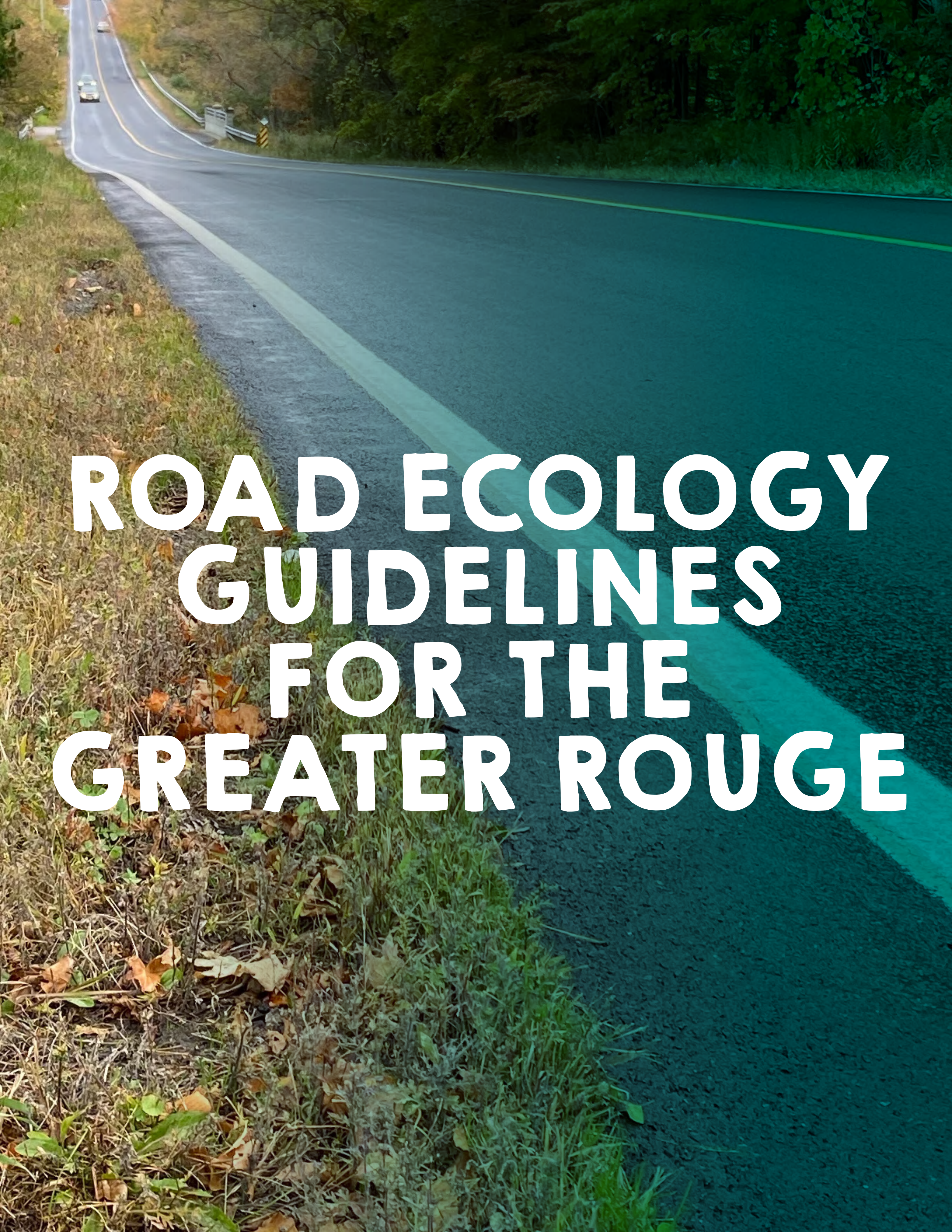
Exclusion barrier material should be attached to the wing walls or bridge abutments and extend at an angle away from the bridge abutment. Temporary fencing may be added as a pilot study to evaluate how smaller snakes respond and move along the fence. It is essential to install the fence in the correct location in relation to the road and bridge. Small animals cannot move far and movements need to be optimized for safe movements to access resources to avoid overheating and dehydration.

Photo 1: Discussing different exclusion fence/barrier types along roads at the workshop.

Photo 2: Terrestrial pathway under bridge at Rouge creek and Reesor road where a snake mortality hotspot was detected.

Photo 3: Guiderails are often found along creek road crossings and can be utilized as a barrier for wildlife access onto the road.

Photo 4: Road-killed Dekay's brown snake on Reesor road found during the field trip.


ROAD ECOLOGY
GUIDELINES
FOR THE
GREATER ROUGE

A key document to guide integration of wildlife passage with stream crossing infrastructure is available from TRCA (2015). In many cases where water from wetlands, creeks and rivers are crossing roads, wildlife is also abundant and will require modifications to structures to improve passage and connectivity. Considerations for both water flow and wildlife passage need to be assessed when designing each structure. The TRCA document provides considerations for both aquatic and terrestrial wildlife at stream crossings in Appendix 3 (TRCA, 2015). At prioritized location for multiple terrestrial and aquatic species it is ideal to provide an open span structure that will maintains the natural environment and wet and dry substrates to mimic the natural terrestrial and aquatic function.

Additional considerations at stream crossings include minimizing use of rip rap and other concrete obstacles that will inhibit wildlife and hydraulic flow. Additional structures such as boulders, woody debris and 'warming structures' for cold-blooded animals are essential. Boulders can be strategically placed to optimize water flow and to provide stepping stones for animals such as frogs to 'rest' while moving through a passage. Native plantings that inhibit erosion, provide food and shelter are also ideal.

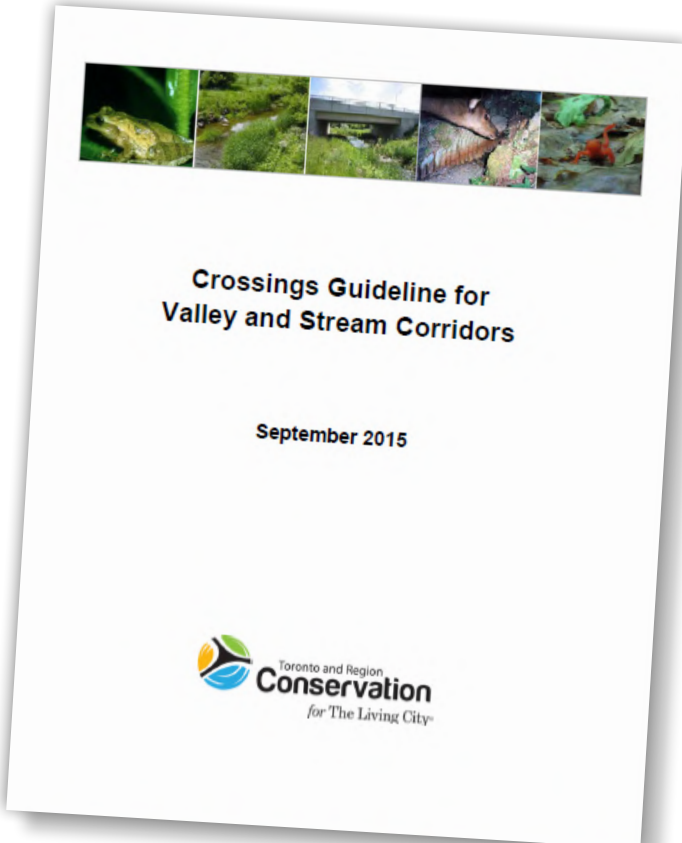
Examples of rip rap used at culvert and bridge pathways that IS NOT recommended for small animal passage at creek and stream terrestrial pathways.

A terrestrial bench added to a hydraulic culvert and a terrestrial dry bench built-into the slop at a creek bridge on Highway 69.

FUTURE WORK

There are number of wildlife on road data available within Rouge Urban National Park from 2011 to 2021 (Eco-Kare International 2022). These data combined with data collected by the TRCA on selected roads in the region will be ideal to delineate where vertebrate taxa are crossing roads and or verify any predicted road crossing locations for wetland-forest species.

As part of the Eco-Kare International 2021 data collections in RUNP a road mortality hotspot was observed where the Rouge River crosses Reesor Road north of Steeles. There were numerous red-bellied snakes, Dekay's brown snakes, and eastern garter snakes road-killed along several hundred metres of road in October. This snake hotspot was confirmed during our October 6th, 2022 workshop. In addition, more snakes were found road-killed along Scarborough-Pickering Townline Road.



During a follow-up meeting with the Namrata Shrestha and David Lowry, research scientists, TRCA on November 24th, 2022, it was noted that the primary taxa being road-killed in the study area were amphibians. It is recommended to obtain these data and utilize the data to define road mortality hotspots. Future data collections in the area should focus on obtaining amphibian road-kill data on selected warm rainy evenings in the spring months and snake road-kill data in the warm days in the fall.

In addition, it is recommended to define parameters/variables associated with wildlife crossing hotspots across roads and to map these predictions. All hotspots should then be verified with wildlife on road data. Furthermore, all road-related data that includes traffic volume, road type (gravel, paved, or dirt), number of lanes, new road extensions, and road maintenance and upgrade schedules should be obtained. This information is essential to prioritize the road mortality risk due to traffic volumes and also to find opportunities for implementation of road mitigation solutions.

OTHER DATA SETS TO OBTAIN:

Fauna observations and wildlife on roads data from the Toronto and Region Conservation Authority	Map where stream, creek and wetland road crossings occur in addition to culverts and bridges and prioritize these hydraulic crossing for adaptations to allow wildlife passage	Evaluate existing infrastructure at prioritized stream, creek and wetland crossings for wildlife passage
Collect field data targeting amphibians and snakes found on roads during spring amphibian migrations and fall snake migrations	Obtain traffic volume, and road upgrade schedules from the respective municipalities	Provide workshops and training for the associated municipalities to implement best practices for connectivity and road ecology into mainstream activities.

ECOLOGICAL CORRIDOR ESTABLISHMENT

More work needs to be done to identify additional ecological corridors around Rouge National Urban Park and the policies and mechanisms for establishing long-term security.

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ADDITIONAL RESOURCES:

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APPENDIX A:

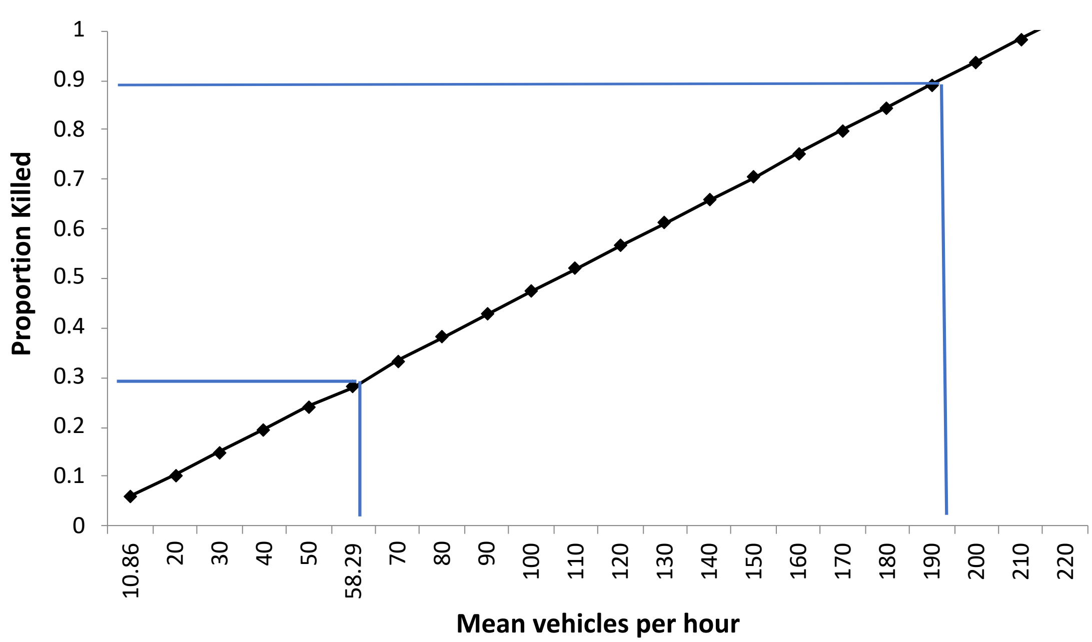
PROBABILITY OF A VEHICLE COLLISION WITH A FROG

Previous research has shown that a frog's inability to avoid roads and their slow movement make them particularly vulnerable to road mortality, which likely explains the strong negative effects of roads on frog populations. Jaarsma et al. (2006) has shown that traffic volume and an animal's traversing speed have the largest effects on whether a collision occurs. A study by Bouchard et al. (2009) showed that on very low traffic roads (10.86 mean vehicles per hour), 94% of frogs crossed the road successfully, whereas at higher traffic roads (58.29 mean vehicles per hour) 72% were successful.

Research by Gibbs and Shriver (2005) have shown that local population expirations are likely when road morality reaches >10% of adults. In other words, if traffic volumes are at a level where all animals on the road are road-kill and if >10% of the adults cross than a local population extinction will occur.

The following considerations are required for model prediction:

- We assumed that the relationship between traffic volume and frog crossings is linear, by regressing two field points collected from Bouchard et al. (2009). However, the relationship may not be linear if there is a barrier effect such that frogs will not cross roads with higher traffic volumes; furthermore, additional data along roads with varying traffic volumes would fine tune the relationship between traffic volume and amphibian road-kill rates;
- Mean hourly traffic volumes are important to consider in context of where frog road crossings occur because traffic volumes will vary at each location along a road
- Mean hourly traffic volumes are important to consider in context of when frog road crossings occur because traffic volumes will vary by day of week, time of day, season, and weather



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