ECS Lunch and Learn

Supporting internal knowledge transfer within TRCA

May 26, 2022

Toronto and Region Conservation Authority

Natural Systems Climate Change Adaptation: Best Practices Review and Applications

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Toronto and Region Conservation Authority

Climate Change and Natural Systems

- Climate change and associated extreme events and variability continue to impact natural systems in many ways
- Level of impact depend on the many factors including <u>vulnerability</u> of the system to the climate drivers

> **"Vulnerability encompasses … sensitivity or susceptibility to harm and lack of capacity to cope and adapt."**

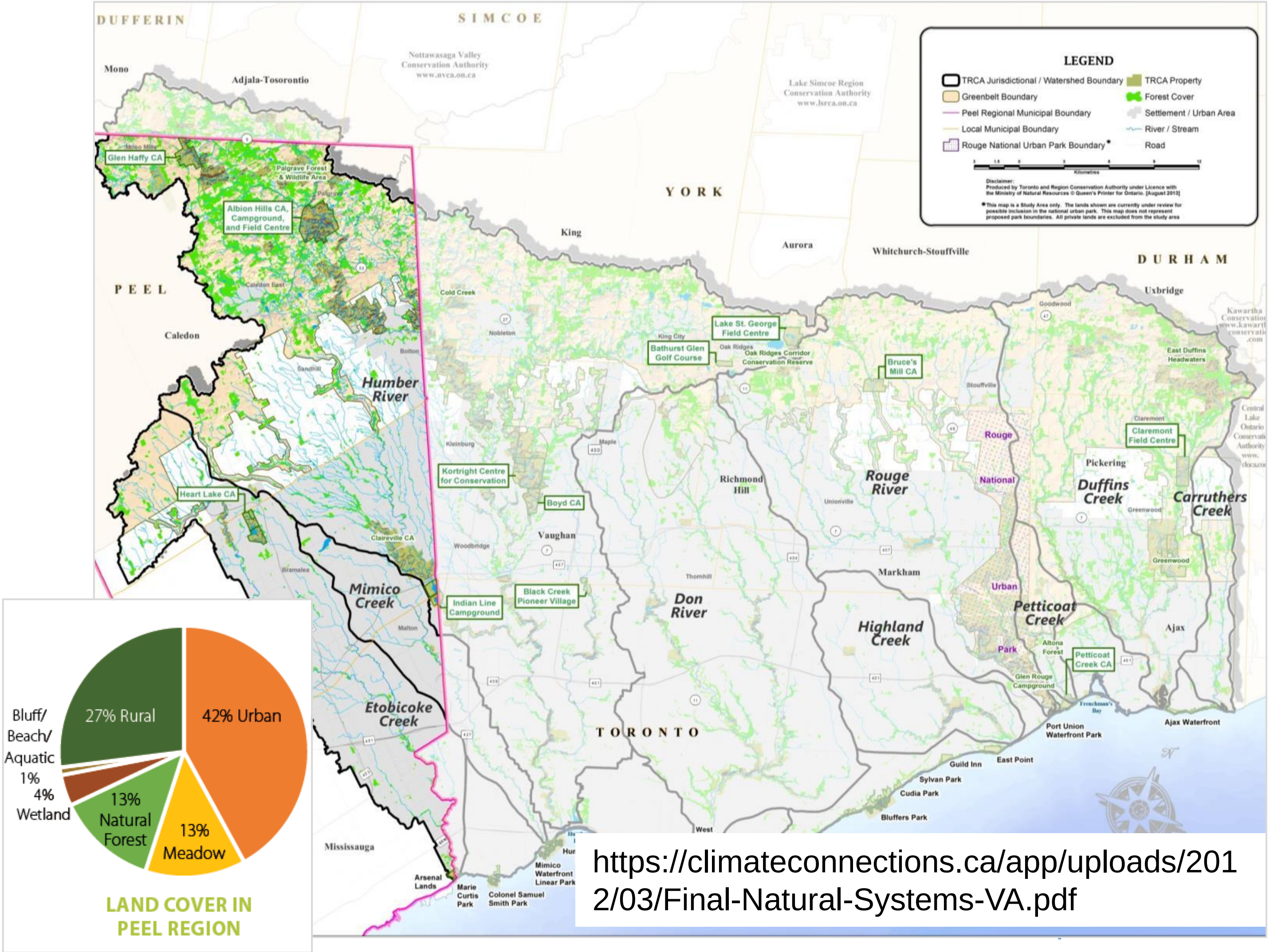
Peel Natural System Climate Change Vulnerability Assessment (TRCA & OCC 2017)

- **Purpose**:
  To understand and map vulnerabilities of existing natural systems to climate change impacts to inform policy, planning, and practice

- **Key concepts**:
  - **Climate drivers**: Represents the climatic conditions that affects natural systems in some ways. They result from a combination of climate variables.
  - **Vulnerability Factors (VFs):** Represents characteristic of a natural component that makes them vulnerable to a given climatic condition. They can be physical, chemical or biological.
  - **Vulnerability Indicators (VIs):** Represent VFs and are measurable. They were selected from a long list based on their f*easibility, importance,* and *scientific validity for assessment*

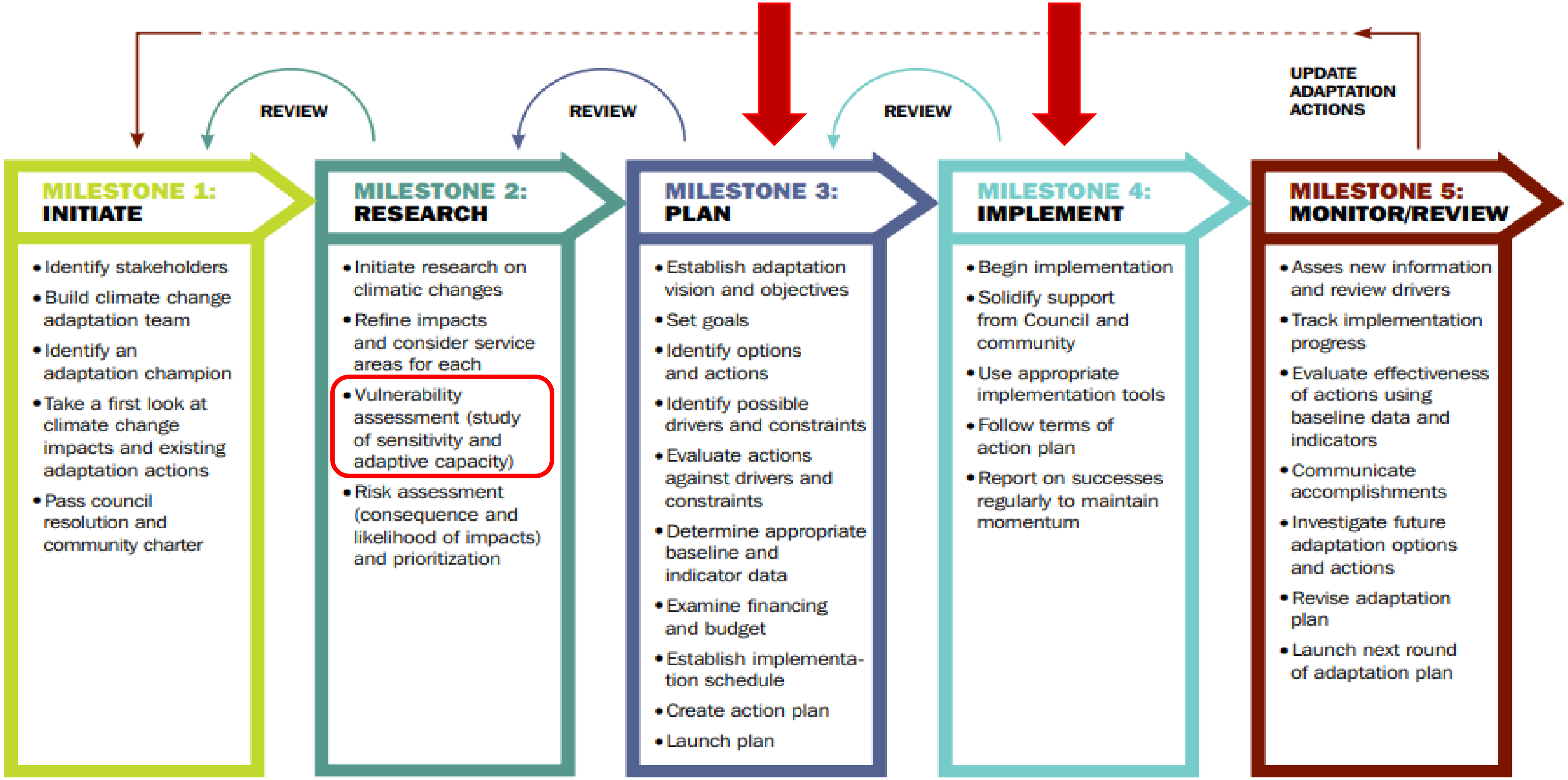
Peel Natural System Climate Change Vulnerability Assessment (TRCA & OCC 2017)

- Semi-quantitative vulnerability assessment
- Focus on <u>Groundwater, Aquatic, Terrestrial</u>
- Desktop analysis based on available data on climate and natural systems
- Outputs include vulnerability maps, case studies, and recommendations
- Next steps included identifying how best to address these climate vulnerabilities



https://climateconnections.ca/app/uploads/2012/03/Final-Natural-Systems-VA.pdf

Framework for Adaptation Planning



International Council for Local Environmental Initiatives. 2010. "Changing Climate, Changing Communities: Guide and Workbook for Municipal Climate Action."
https://icleicanada.org/wp-content/uploads/2019/07/Guide.pdf

NS-CCVA: TERRESTRIAL SYSTEM

Terrestrial System

Components	Vulnerability Factors	Vulnerability Indicators
• Meadows, Grasslands, Shrublands • Natural Forests • Urban Forests • Wetlands	• Pervious Cover • Degree of Connectivity (Habitat & Hydrologic) • Topography and Grade • Soil Quality • Urban Forest Canopy • Thermal Gradient • Community Range	• Natural Cover: Forest Cover & Wetland Cover • Wetland Type • Habitat Patch Quality • Soil Drainage • Soil Organic Carbon in A-Horizon Layer • Urban Forest Canopy • Land surface temperature • Climate-Sensitive Native Vegetation

Terrestrial System: In natural areas

- Areas with low **natural cover** have high vulnerability due to limited stress buffering capacity
- Low **habitat patch quality** have high vulnerability due to existing stress and edge effects
- **Wetlands** with limited water sources have high vulnerability due to the drought effects and uncertainties in precipitation

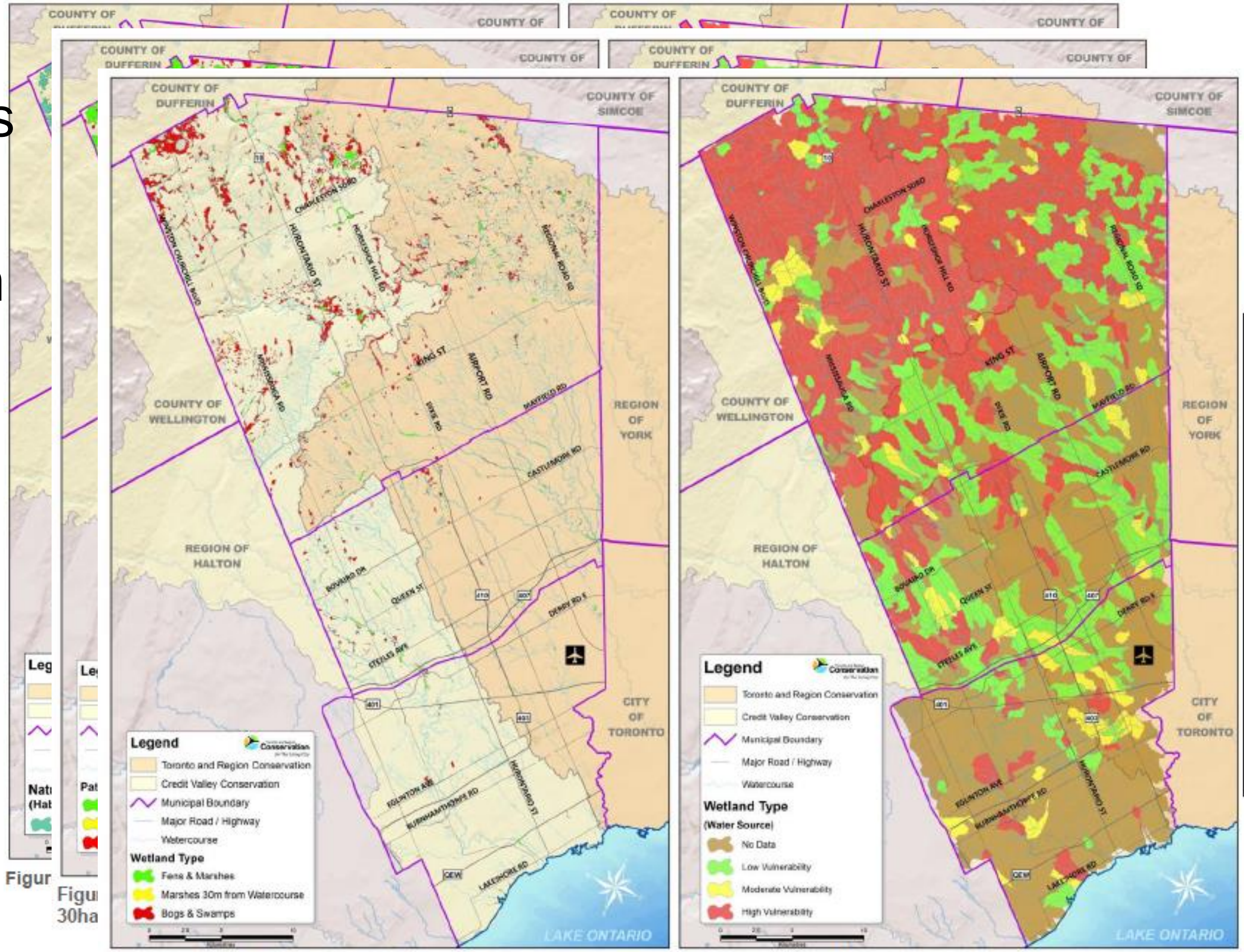


Figure 26: Wetland Type (A) and Vulnerability Characterization of Wetland Type (Hydrologic Connectivity) at the 30ha Catchment Level (B)

Functional Wetland Types used to Characterize Vulnerability based on water source:

Low Vulnerability: Fens, Marshes within 30m of a watercourse

Moderate Vulnerability: Marshes further than 30m from a watercourse

High Vulnerability: Bogs, Swamps

Terrestrial System: In natural areas

- Habitat patches with **climate sensitive vegetation** are more vulnerable
- High potential for compositional shifts resulting in cascade effects (including in protected areas)
- Proactively target habitat management to incorporate climate lens to avoid undesirable shifts

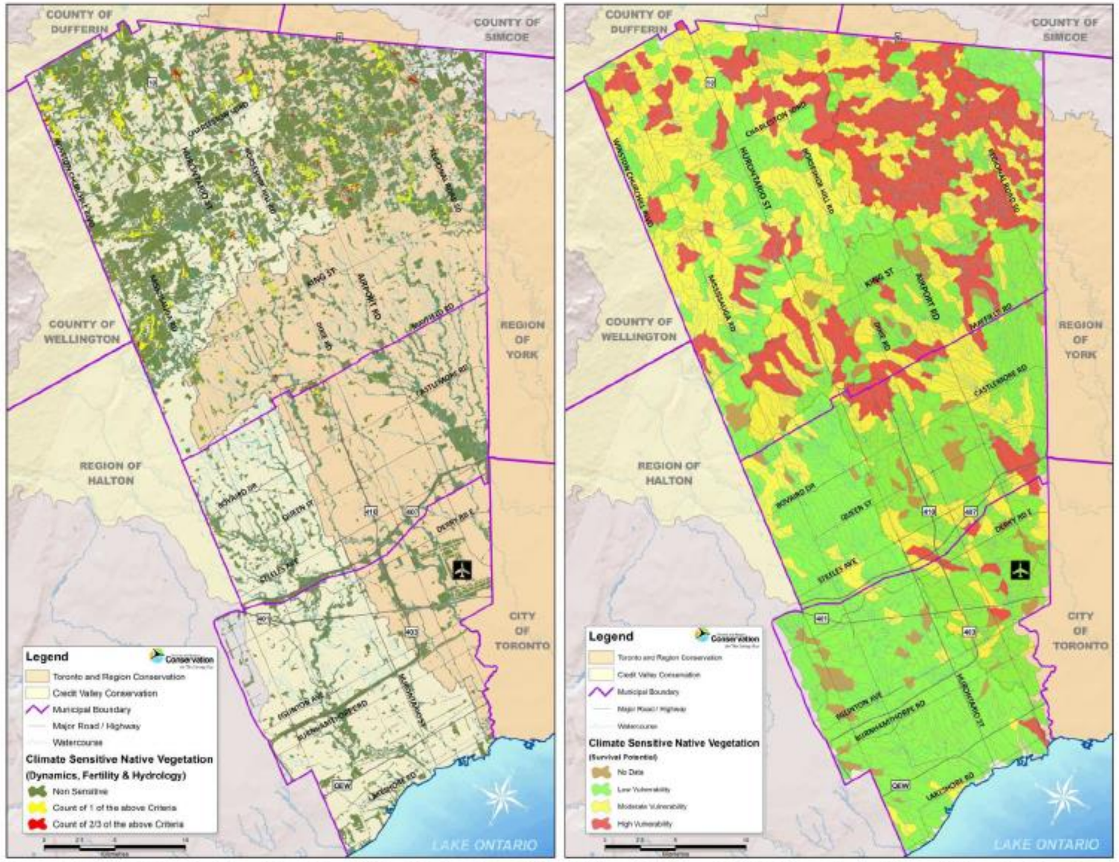


Figure 31: ELC Climate Sensitive Vegetation Native Vegetation (A) and Vulnerability Characterization of Climate Sensitive Native Vegetation (Survival Potential) at the 30ha Catchment Level (B)

Thresholds defined based on the number of climate sensitive criteria (hydrology, fertility, and dynamics):

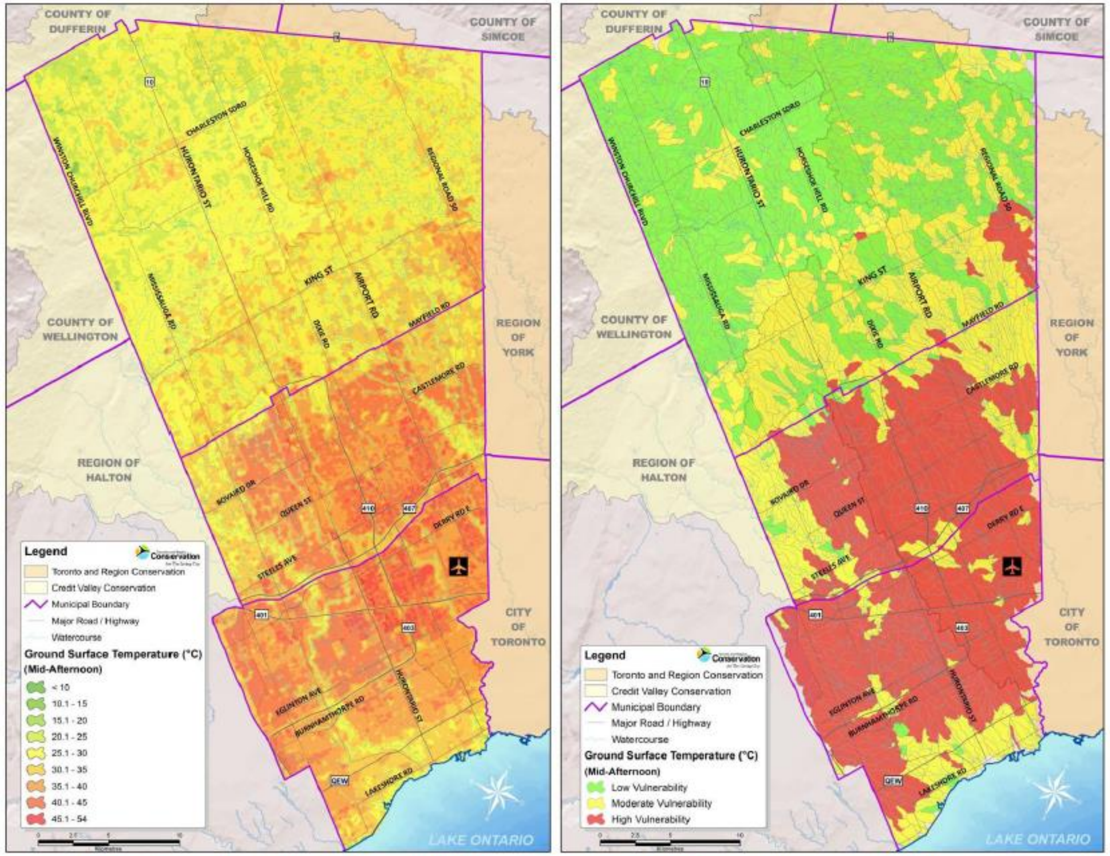
Low Vulnerability: Non Climate Sensitive Native Vegetation

Moderate Vulnerability: Climate Sensitive Vegetation based on 1 of the above criteria

High Vulnerability: Climate Sensitive Vegetation based on 2 or more of the above criteria

Terrestrial System: In broader landscape

- Areas with high **ground surface temperature** are more vulnerable due to heat impacts
- Increasing imperviousness and urban heat island effects will exacerbate impacts
- Implement various green infrastructure measures to reduce heat and decrease vulnerability



Range-based Thresholds Applied to Characterize the Gradient in Peel:

Low Vulnerability: Less than 29˚C

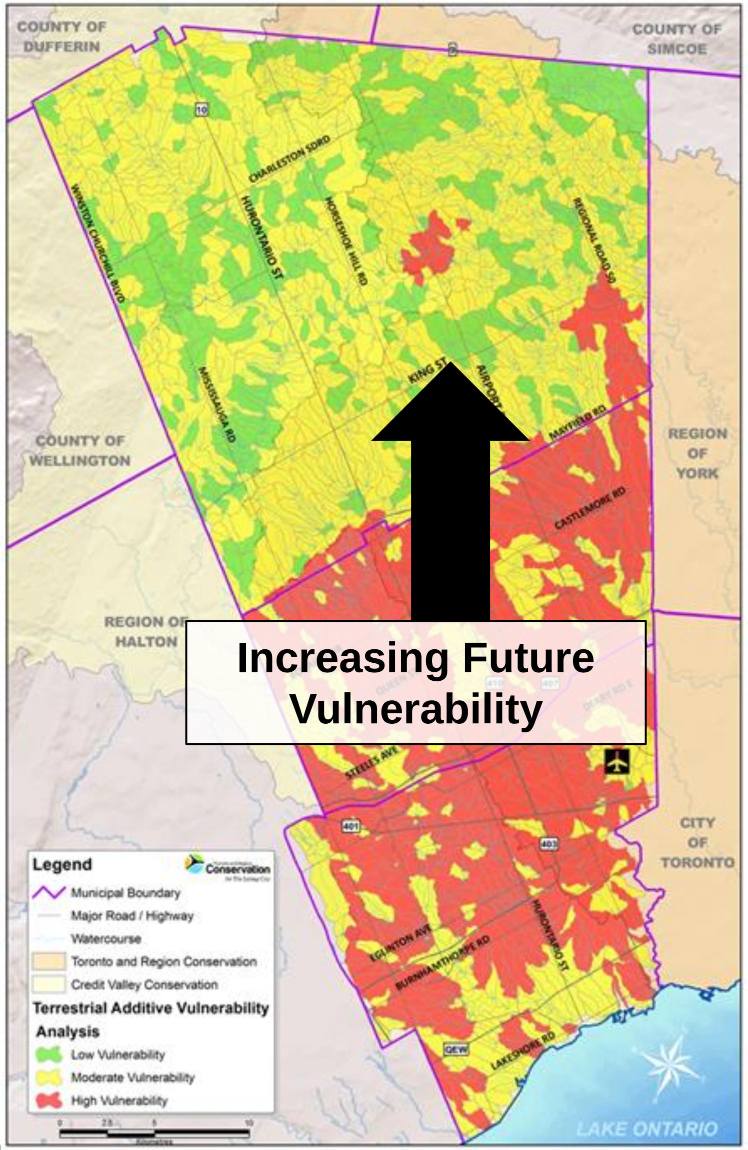
Moderate Vulnerability: Between 29˚C and 36˚C

High Vulnerability: Greater than 36˚C

Figure 30: Mid-Afternoon Ground Surface Temperature on June 18, 2014 (A) and Vulnerability Characterization of Mid-Afternoon Ground Surface Temperature at the 30ha Catchment Level (B)

Terrestrial System: Overall

- 55% of Peel’s terrestrial system is highly vulnerable, mostly in urban and urbanizing areas
- Increasing trend, especially as urbanization expands because climate change and urbanization are threat multipliers
    - Decrease adaptive capacity due to decreased connectivity and increased fragmentation
    - Further degradation of ecosystem form, functions, and services (e.g. habitat, water management, heat regulation)
    - Compromised resilience overall – for natural and anthropogenic systems



Vulnerability of Terrestrial System

BEST PRACTICES FOR ADAPTATION

Natural System Climate Adaptation Best Practices Review (2020-2021)

Literature review	Undertake a literature review / land scape scan of peer-review and grey literature to identify a list of best practices for ecosystem management to address / adapt to identified climate vulnerabilities
Refined best practices list	Refine the list of best practices to identify the pertinent ones based on land management, land use planning, governance and institutional context of Peel Region.
Deep dives	Select 4 best practices to undertake “deep dive” review to improve understanding of approaches and methods used by others and how they can be applied to Peel Region.
Case studies	Develop 4 site-specific case studies (2 in TRCA and 2 in CVC jurisdiction) to illustrate how identified best practices could be implemented at a site level (intended to be implemented, when possible, by TRCA & CVC)

1. Literature Review & Best Practices List

- Provides a high-level tool identifying the best practices and references for addressing climate vulnerabilities of terrestrial and aquatic ecosystems
- Connects the best practices with the identified vulnerability indicators
- However, provides limited details on specific methods and approaches (addressed in the next task for select best practices)
- Scoped to include on-the ground practice and policy options examples from outside TRCA and CVC

Best Practices List for Terrestrial

On-the-ground Actions

- Invasive species management
- Manage forests to minimize spread of new pests and pathogens
- Herbivory management
- Management to reduce risk and impacts of severe disturbances
- Plant species with broader climate tolerances
- Increase species, genetic and structural diversity
- Translocation, relocation or assisted migration / dispersal / colonization
- Identify and maintain refugia
- Green infrastructure and Low Impact Development

Policy options

- Strengthening woodland protection, restoration and creation policies
- Encourage sustainable harvesting plans on private lands that are managed for wood products
- Mandate / promote responsible forest genetic management
- Incorporate climate change into species and land-management plans, programs and activities
- Create, restore and protect natural features
- Prioritized systematic planning of buffers for protected areas to maximize resilience
- Identify and protect areas for species expected to be displaced by climate change

Other Best Practices

- Increase connectivity between habitats

Best Practices List for Aquatic

On-the-ground Actions

- Mitigate unneeded in-stream structures
- Manage impoundments / reservoirs to provide timely releases of cold water downstream
- Control unnatural stream bank erosion (structural, natural channel design and bioengineering methods)
- Create and restore in-stream habitat
- Protect / restore shallow water flow paths (streams)
- Remove / restore unneeded channelization, incised or straightened features
- Plant range of native species in riparian and floodplain habitat
- Protect refugia habitats

Policy options

- Restrict water taking / extraction during drought
- Review and increase (if required) minimum development setbacks / restrictions on particular land uses near aquatic components
- Promote stormwater infiltration (i.e., control stormwater runoff)
- Reduce nutrient loading to aquatic components

Table 3: Preliminary List of Best Practices for Terrestrial System Components

Best Practice	Terrestrial System Component(s)	Vulnerability Indicator (Vulnerability Factor): Natural Cover *(Pervious Cover; Degree of [Habitat] Connectivity)*	Wetland Type *(Degree of [Hydrologic] Connectivity)*	Land Surface Temperature *(Thermal Gradient)*	Habitat Patch Quality *(Degree of [Habitat] Connectivity)*	Soil Drainage *(Topography and Grade; Soil Quality)*	Climate-sensitive Native Vegetation *(Community Range)*	Description / Mechanism / Rationale	Benefits & Risks	Level of Required Effort: Cost [I]	Timeline [II]	References
On-the-ground Actions												
Invasive species management	Natural Forests; Meadows, Grasslands and Shrublands; Wetlands	✓			✓		✓	▪ Prevent introduction and establishment of invasive species, emphasizing early detection and response to new infestations, and control existing invasive species through the development of formal programs and public education. ▪ Climate change is expected to facilitate rapidly reproducing and vagile species, particularly those considered invasive. ▪ Research how existing or new invasive species may impact terrestrial ecosystems in Peel under changing climate. ▪ Invasive species outcompete native species and alter structure and composition of native communities. Invasive plant species are frequently less palatable or nutritious and reduce vigour of native herbivores; can lead to altered fire pattern and complete vegetation shift.	Benefits: ▪ Reduces impact of biological stressors that can amplify effects of climate change (e.g., susceptibility to drought); thereby, increasing ability of species and ecosystems to adapt. ▪ Prevents loss of biodiversity. ▪ Dealing with existing stressors is a relatively high-benefit, low-risk strategy for climate change adaption, in part because of the existing body of knowledge about their impacts and solutions. ▪ Used to maintain existing plant communities until other strategies can be implemented. Risks: ▪ Intensive / direct management is expensive and usually only feasible at small, well-defined sites such as protected natural areas. ▪ Potential for management to negatively impact some native species.	$$$	Recurring	Gross et al., 2016; Galatowitsch et al., 2009; Swanston et al., 2016; Varrin et al., 2007; Mawdsley et al., 2009
Green infrastructure and Low Impact Development (LID)	Meadows, Grasslands and Shrublands; Wetlands	✓		✓	✓	✓		▪ Includes engineered features with natural elements (e.g., roofs that support vegetation or green roof, stormwater management ponds with surrounding vegetation buffer, bioswales) or natural features, such as remnant habitat or the urban tree canopy, that are within or around urban development. ▪ Engineered features with natural elements should be used in conjunction with protection of natural features through conservation planning and policies, and where opportunities for restoration are limited. ▪ Biodiversity can be enhanced by using diverse assemblage of native species that are suitable for urban environments. ▪ Biodiversity benefits will be greater where planning ensures connectivity of the green infrastructure including naturel features within and around urban development.	Benefits: ▪ Reduce urban heat island effect (i.e., tendency of urban areas to promote higher local temperatures and to retain them for longer time periods than non-urban areas). ▪ Decrease the risk of urban and riverine flooding by intercepting, storing and slowing the speed of surface runoff. Risks: ▪ May be a source of invasive plant species that are able to colonize more natural areas. Green roofs for example almost exclusively use non-native plants.	$$	Recurring	Tu et al., 2017; Heller and Zavaleta, 2009; Filazzola et al., 2019; Bowers et al., 2014
Policy Option												
Strengthening woodland protection, restoration and creation policies	Natural Forests	✓		✓	✓			▪ Woodland protection in governing policies for the watershed is a crucial component of sustainable land management and forest ecosystem conservation. ▪ Policies should be directed to restore degraded woodlands and improve resiliency against threats	Benefits: ▪ Better ensures long term protection of woodlands which in turn helps buffer effects of climate change. ▪ Increases public awareness and support for woodland protection Risks:	N/A	Recurring	Tu et al., 2017; LSRCA, 2018

2. Deep Dives

photo: TRCA Claireville, credit: Lou Wise

Deep dive on 4 best practices:
To improve understanding on state of science and practice beyond TRCA and CVC jurisdiction to combine with our knowledge

- Increase species, genetic and structural diversity
- Invasive species management
- Protect / restore shallow water flow paths
- Protect refugia habitats

Identified examples of best practice, potential benefits and risks of implementation

Discussed application in Peel, including data gaps

Identified recommendations for next steps

1. *Increase species, genetic and structural diversity*

Description

- Enhancing the resilience of climate-sensitive native vegetation through **assisted migration**
- Enhancing and increasing natural cover for **habitat connectivity**

Tools

- Climate Adapted Species Palette Tool
- Planting Palette Tool (Sierra Nevada, California)
- Interactive City-to-City Climate Shift Projections Mapping Tool

Example of Best Practice

- Adaptive Silviculture for Climate Change (ASCC) in the Petawawa Research Forest, Ontario

1. *Increase species, genetic and structural diversity*

Description

- Enhancing the resilience of climate-sensitive native vegetation through **assisted migration**
- Enhancing and increasing natural cover for **habitat connectivity**

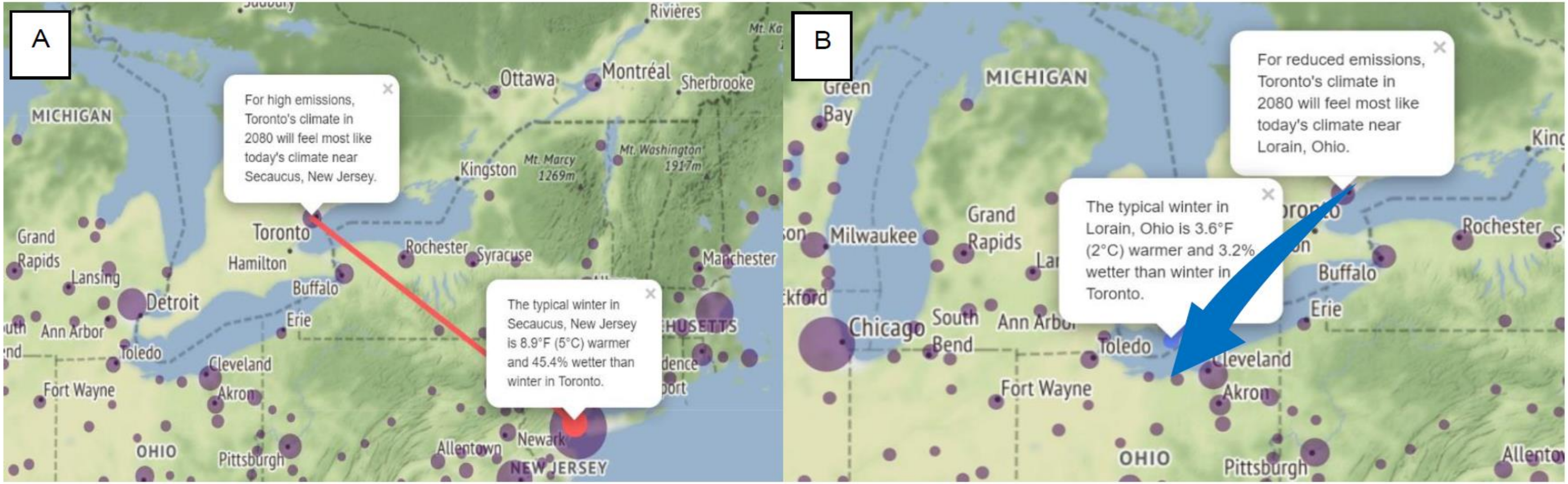


Figure 1. Depictions of climate-analog mapping for Toronto, Canada under (A) current, high emissions, and (B) a reduction in emissions by mid-century representing what the climate may look like in the region by 2080.

2. *Invasive Species Management*

Definition

- Preventing introduction and establishment of invasive species associated with climate change.
- Early detection and response to new infestations associated with climate change
- Control of existing invasive species that may spread due to climate change

Examples of Best Practices

- Predicting invasive plant responses to climate change and prioritization for mapping and management, Biodiversity Management and Climate Change Adaptation Project
- Northeast Regional Invasive Species and Climate Change (RISCC) Management Network, Northeastern United States

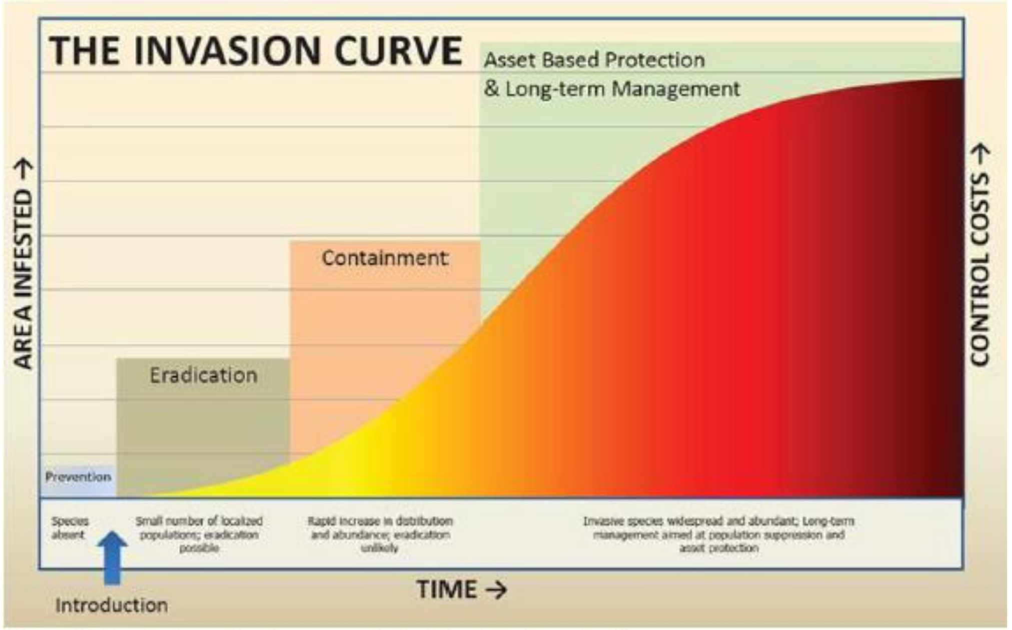


Figure 1. Species Invasion Curve as adapted from Rodgers (n.d.).

Summary

- Literature review of the best practices provide us with a high-level tool/table with specific best practices and references linked with identified vulnerabilities in Peel Region to inform adaptation planning
- Deep dives highlighted new resources and toolkits that could be useful for our initiatives
- Showcased that many of the global initiatives and tools are aligned with our existing tools and policy frameworks
- Help inform the case studies and actual applications …

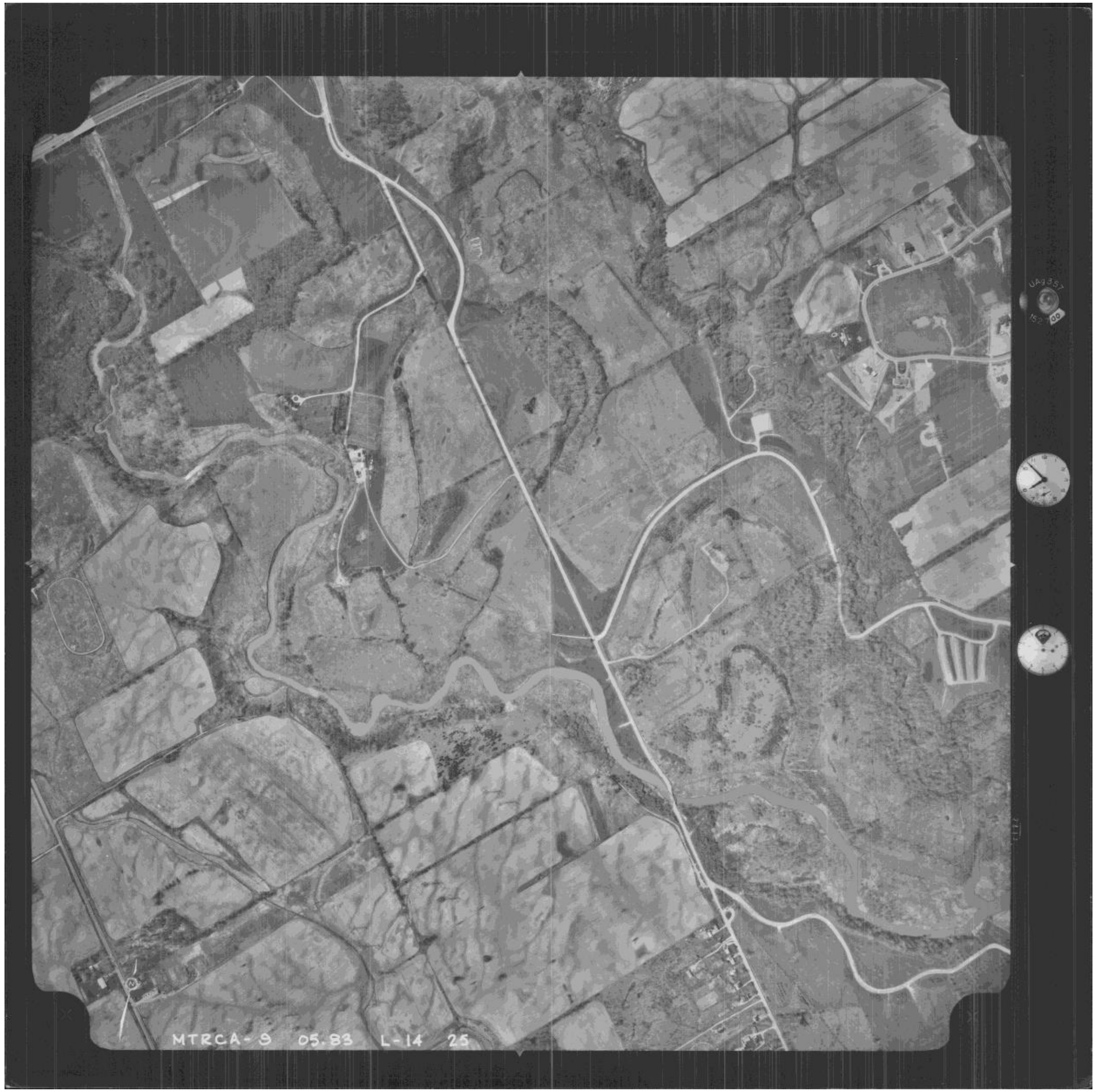
Agenda

Review Project Examples Addressing Climate Vulnerabilities with Focus on Deep Dive BMPs at Various Restoration Projects in Peel Region

1. Claireville CA Natural Areas Restoration
2. Bramelea and JJJ Natural Channel Projects
3. Kings Park Stream Restoration

Claireville CA

Claireville History and Background



Claireville CA was acquired in 1957 following Hurricane Hazel for flood protection.

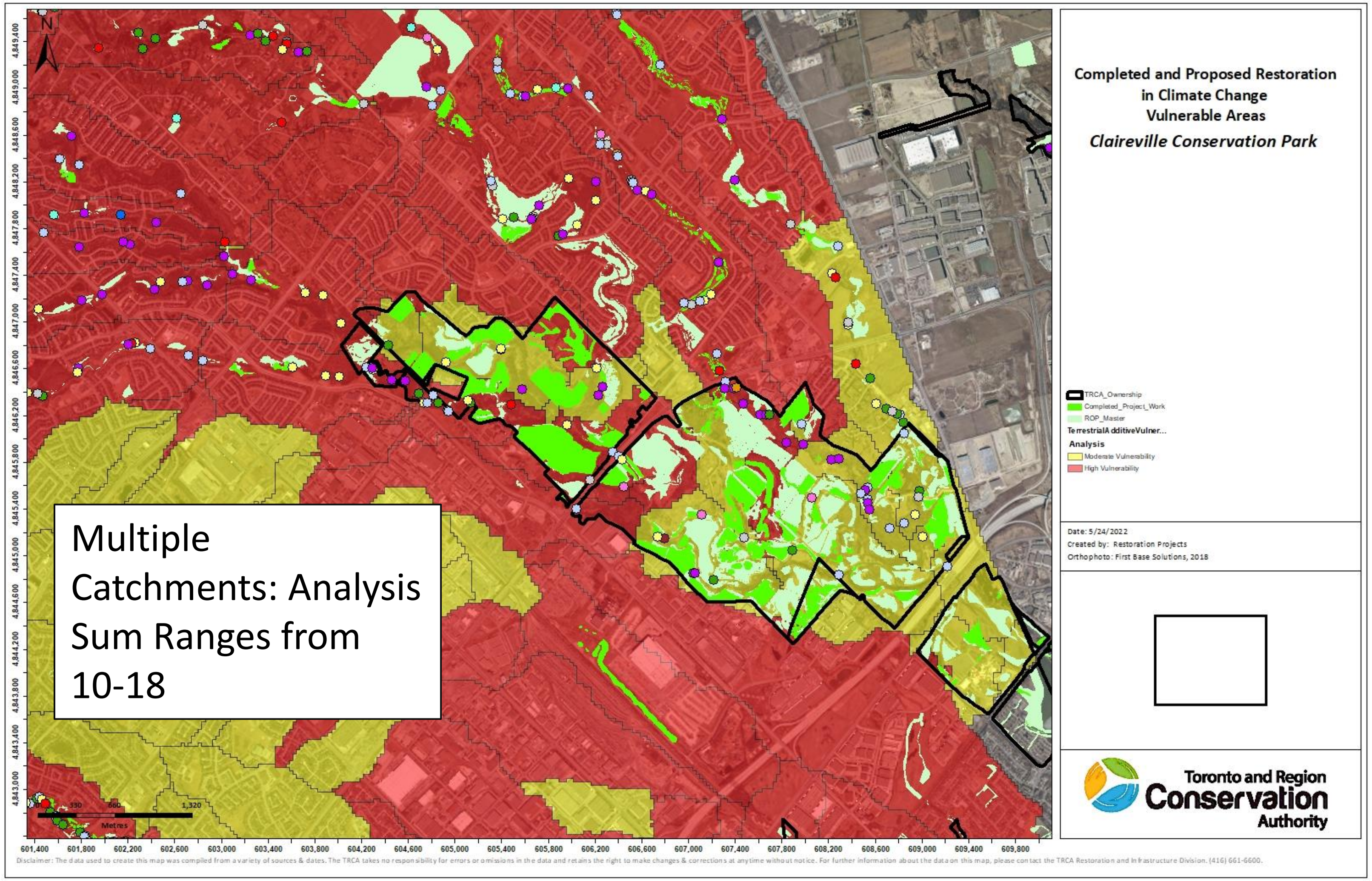
From City of Toronto Property to Ebeneezer Management Tract North of Queen it is 848 ha

This photo is from 1983. Landuse within and surrounding Claireville was primarily Agricultural and much natural cover had been cleared and wetlands drained.

A Restoration work in progress

Claireville *2011(2012)-2019 Restoration Totals (RRM)	
Woody Stems (Tree and Shrub Units)	103,107 (Low not all plantings have been recorded)
Forest Habitat Restored (ha)	45
Wetland Habitat Created or Restored (Ha)	9
Riparian Habitat Restored (ha)	7
Riparian Habitat Restored (m)	2919
Meadow Habitat Created/Restored	9
Stream Restoration (m)	1109
Aquatic Barriers Mitigated (Count)	1
Forest Management Thinning (ha)	9
Forest Management Inventory (ha)	125
*Totals don't include all community-based works	

Terrestrial Vulnerability Additive Analysis (Catchments) - Claireville CP



Multiple Catchments: Analysis Sum Ranges from 10-18

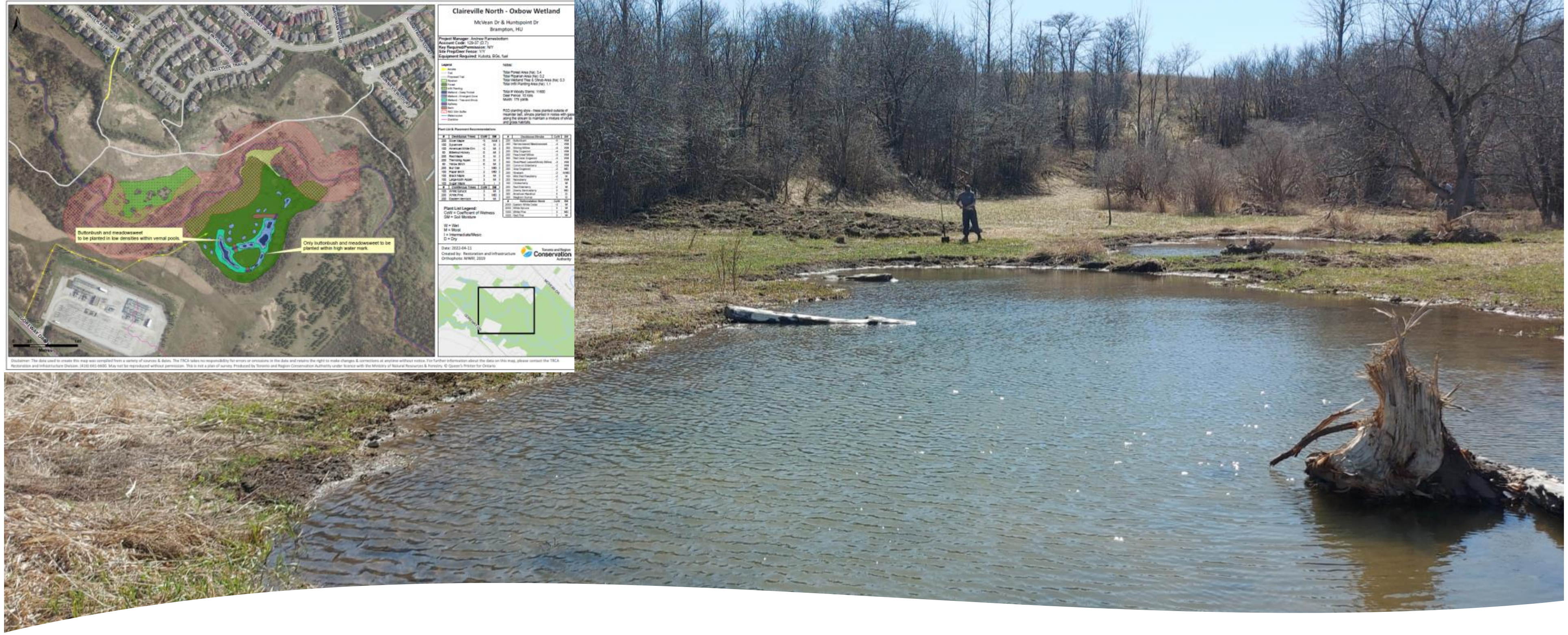
Climate Change Vulnerabilities

Vulnerability Indicator	Vulnerability Indicator Score	Applicability and Reccomendation
Water Temperature	The CCA includes the **downstream end of a priority reach for stream water temperature monitoring stations** **Absolute maximum future weekly temperatures have been assessed ranging from 24 –29̊ C.** This ranges from below the absolute maximum biological tolerance threshold for coldwater systems (26̊ C) and between the ranges of cool-and warm-water systems (28̊ C and 30̊ C, respectively).	Increased maximum stream temperatures may cause a decrease in coldwater habitat and may lead to further loss of native fish species due to water temperature tolerances being exceeded. **As part of the range of future water temperature projections remain below the threshold for cold-water systems, which indicates potential for in-stream restoration and naturalization to re-introduce suitable native fish habitat.**
Natural Cover (infiltration)	CCA has been assessed as having a vulnerability indicator score including l**ow, moderate, and High for natural cover (infiltration)**	This range **indicates pervious cover variability within the CCA landscape**, which may lead to increased vulnerability to flooding and impacts to watercourses in the future caused by climate change (where pervious cover is low). **High vulnerability areas coincide with more urbanized areas.** These predominantly impervious areas lead to increased runoff and subsequently thermal stress to aquatic systems from overland flow. **Natural cover within the CCA ranges from 62% (TRCA, 2012) to 88%** (TRCA, 2016a).
Recharge	The CCA has been assessed as having a vulnerability indicator score of **low, moderate, and high for Recharge.**	**Imperfect soil drainage and soil texture (e.g., clay, loam)of the CCA may impact infiltration, and thus, recharge rates for deeper aquifers, local streams, and wetlands.** However, recharge may not always be a local process and is often driven by geological structure (e.g., presence of aquitards, etc.). **Urbanized, impervious areas have the highest vulnerability as a result of lower infiltration rates**, which can both cause reduced recharge and increased flooding/runoff. **Wetland creation within the CCA aims at increasing infiltration and hydrological connectivity (TRCA, 2012).** However, pervious cover remains for some of the land-uses within the CCA (e.g., private, commercial).

Vulnerability Indicator	Vulnerability Indicator Score	Applicability and Recommendation
Natural and Urban Forest Cover	Natural forest cover within the CCA varied in vulnerability indicator scores including **low(>40% natural forest cover), moderate(30-40%), and high (<30%).** Urban forest canopy within CCA varied in vulnerability scores from moderate**(middle third percentile in urban forest canopy) to high (lower third percentile).**	**Much of the southern portion of Peel has high vulnerability to climate change based on forest cover because of historical development and urbanization.** Invasive and non-native species (e.g., common buckthorn; Rhamnus cathartica, Manitoba maple, Norway maple; Acer platanoides) dominate many of the urban woodlots within the region. **Tree planting/forest restoration is aimed at increasing forest cover within the CCA, which ranges from 22% (TRCA, 2012) to 36% (TRCA, 2016a).**
Land Surface Temperature	Land surface temperatures in the **mid-morning** ranged in vulnerability scores from **low(<24˚C) to moderate(25˚C–29˚)**.Land surface Temperatures in the **mid-afternoon** ranged in vulnerability scores including **low(<29˚C), moderate(29˚C–36˚C), and high(>36˚C).**	**Variation in the types of vegetation** communities within the CCA may lead to a land surface thermal gradient driven by urban canopy and other natural cover (e.g., forests, wetland vegetation, etc.)as described above. **Further, natural and urban forest cover is variable within the CCA** and limited within the greater landscape,which may lead to higher land surface temperatures (and subsequently vulnerability).
Habitat Patch Quality	The CCA contains patch qualities of **low (TRCA L-Ranks of L1, L2) and moderate (L3) vulnerability.**	Reduced connectivity may increase the likelihood of invasive species introduction and spread, heat stress to vegetation and vegetation communities, and increased edge effects. **Habitat quality for the CCA ranged from fair to excellent based on size, shape, and matrix influence.** These habitats reflect lower vulnerability to climate change than poor quality patches (e.g., smaller, less connected, less interior forest).
Wetland Type	The CCA is a mosaic of vegetation communities including **wetlands that range in climate vulnerability scores consisting of low, moderate, and high.**	**Nineteen (19) wetland vegetation community types have been identified within the CCA (TRCA, 2016a) covering 46.8 ha (7.1% of natural cover in the CCA**). Three wetland vWetland type can influence habitat availability, flood attenuation, hydrological connectivity, and can improve water quality within Peel Region.
Climate-Sensitive Native Vegetation	Native vegetation within the CCA range in climate sensitivity based on the varying topography and communities. **Vulnerability indicator scores for climate-sensitive native vegetation include low, moderate, and high.**	The CCA consists of a variety of vegetation types(e.g., forest, successional, meadow; TRCA, 2016a) that vary in their reliance on hydrology and soil fertility leading to a range of vulnerability indicator scores. **The CCA contain seven dynamic vegetation types(TRCA, 2016a), which are especially sensitive to climate change.**

Recent Claireville Project Examples Addressing Deep Dive BMPs

Protect Aquatic Refugia
Protect and Restore Shallow Water Flow Paths
Invasive Species Management
Increase Species Genetic, Structural Diversity to Promote Climate Resilience

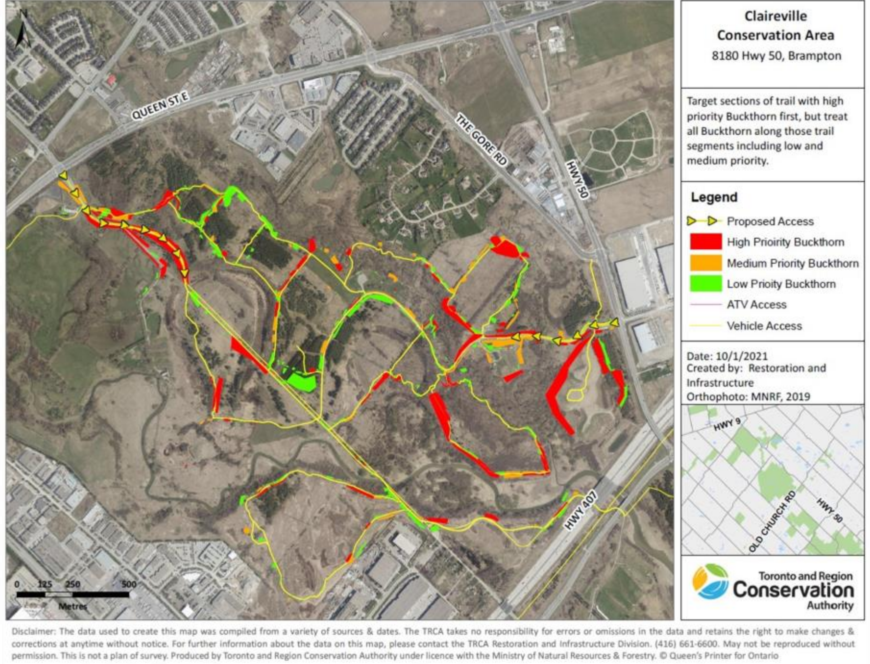


Claireville North Oxbow Wetland Restoration

- ~ 4 Ha of wetland and riparian plantings (south) / ~ 1 ha infill riparian planting (north)
- Wetland was previously contour ploughed to drain
- Install low rise clay keyed berm with vegetated spillway, basin contouring, and added basking and perching logs
- Planted with over 11,600 trees and shrubs (30+ species), Seeded with Native Wetland Seed Mix

Vernal Pools

- ~ 24 Vernal Pools Created to Create connectivity between existing wetlands with chorus frog populations using flow accumulation models, 2.5 ha drainlines, lidar, and detailed soil cores to find suitable shallow flow path locations. Helps to create connectivity, structure, and genetic flow.
- TRCA call monitoring to determine existing use
- Grant and Collaboration with Environment and Climate change Canada for habitat works. ECCC Will be genetically confirming population.



Invasive management

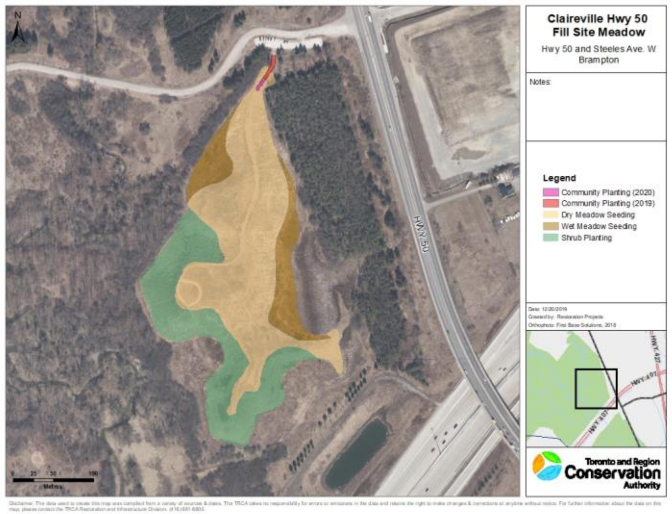
- Following TRCA's strategic invasive management plan
- 20ha of woody invasives to manage
- Use of basal bark herbicide application
- Species include European buckthorn, invasive honeysuckle, Manitoba maple
- Winter application
- Spring planting community events where removal occurred
- Follow-up monitoring in summer
- 12ha treated
- Application areas marked on new Invasive Management layer and Invasive Tracking layer in Collector

Riparian Plantings

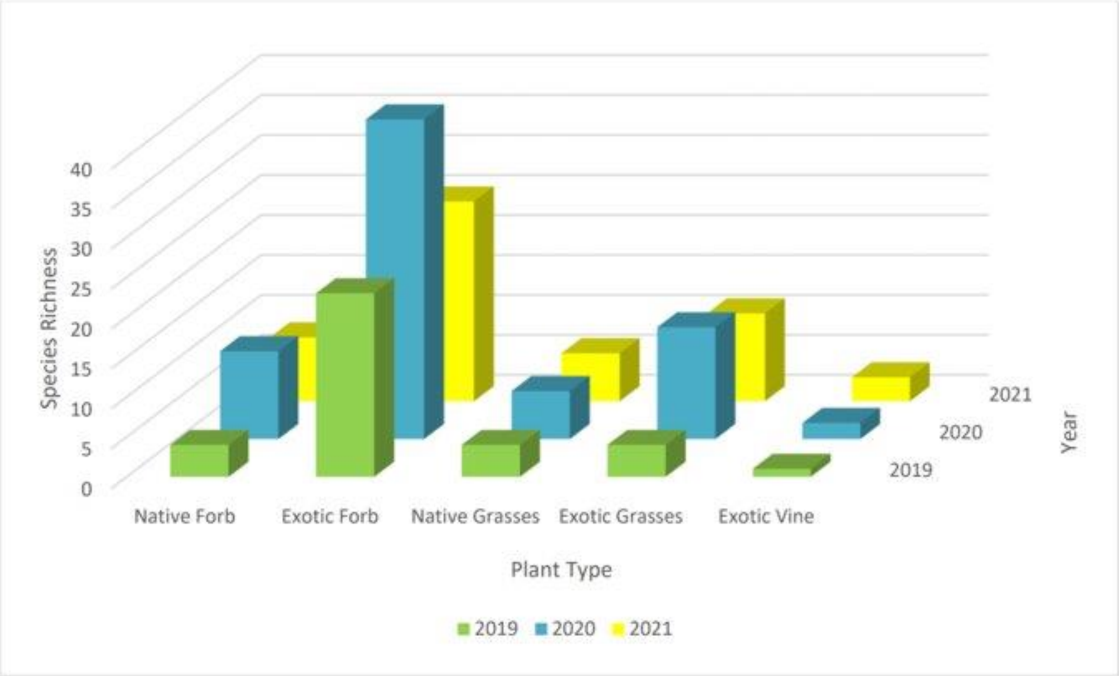
- 2022 Spring Planting at Claireville CA West Humber River at Queen St.
- 0.37 ha, 2039 trees and shrubs, 2400 Bio/engineering stems
- Will continue planting further north in future planting seasons to close the riparian gap to queen street, and adjacent reforestation will be infilled
- Addresses riparian forest connectivity gaps, shades aquatic habitat, protects against erosion, increases tree and shrub diversity

Hwy 50 Meadow – 4 ha inland fill site vegetation restoration.

2018 Site prep – 2022 invasive management and overseeding (adaptive management)



Hwy 50 Meadow

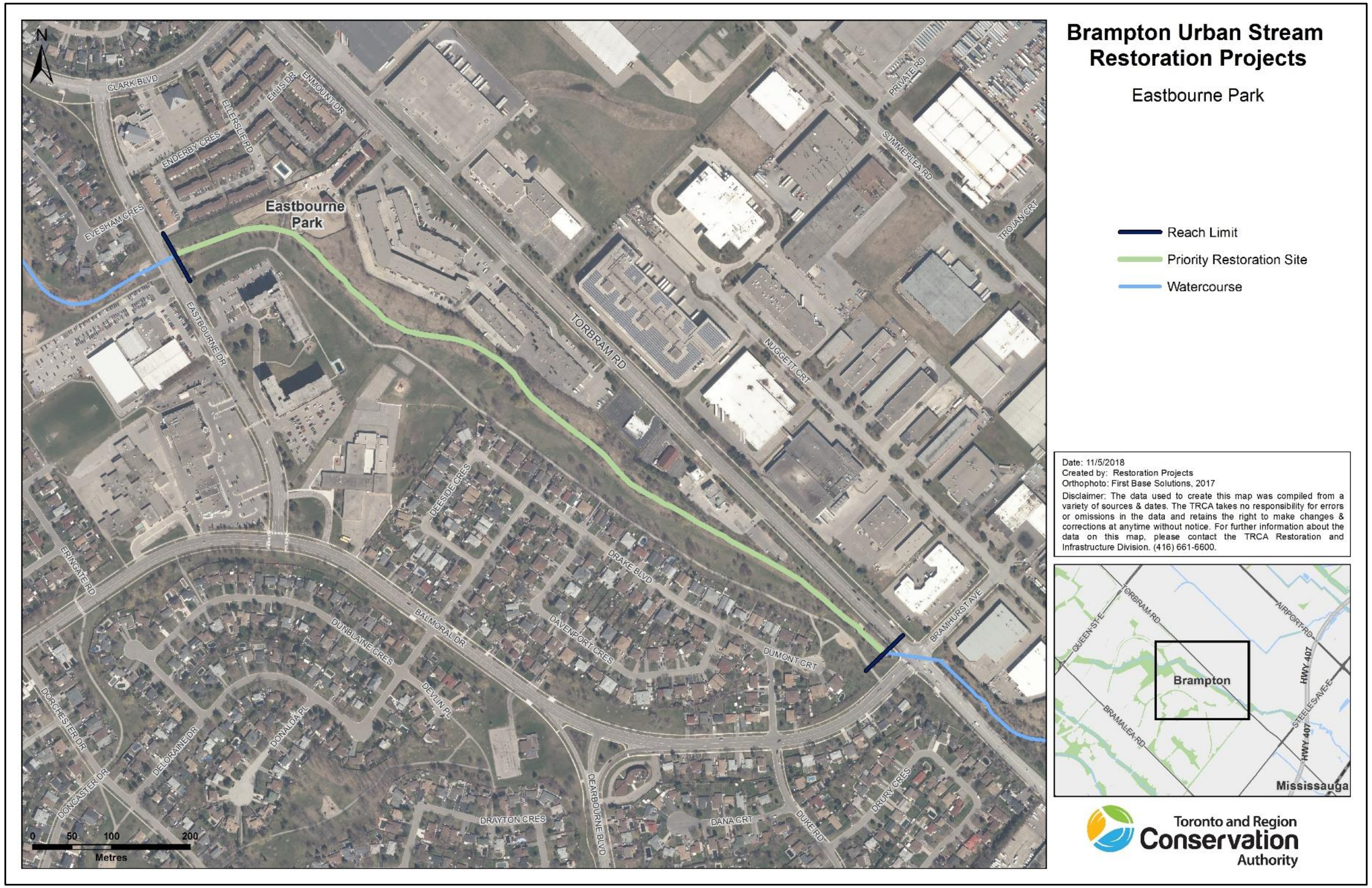


"Overall, the floristic diversity of the meadow increased in the last three years; however, the floristic diversity of the meadow in 2021 was lower by 22 species than in 2020. The ratio of exotic to native remained almost the same. Most of the native species established in the plot (9 of 14) were present in the seed mix (Dry Meadow or Wet Meadow). Only 32% of the species in the Dry Meadow seed mix were observed in 2021. Intense competition and pressure from non-native species continue to be a limiting factor in the establishment of planted meadow species.

Recent Project Highlights Addressing BMPs

Protect Aquatic Refugia Habitats	**Protect and Restore Shallow Water Flow Paths**	**Invasive Species Management**	**Increase Species, Genetic, Structural Diversity to Promote Climate Resilience**
Riparian Planting Completed in 2021, 2022. Site 1 (humber s of queen), Claireville North (IRT trail 2022,2023). Identified gaps in canopy along water courses.	Chorus Frog Vernal Pools, and repair of previously restored oxbow and wet meadow outfall structures to improve connectivity of previously restored wetlands for Chorus frog movement	Mapping of Invasive species (Buckthorn, DSV, phragmites) in CA's within 15m of trails and parking lots	Use of Locally adapted Trees and shrubs from TRCA nursery in reforestation, riparian, wetland, projects. Other nursery's (St. Williams, CVC, Summerville)
Stream and Wetland Restoration Identified for Future works. Large location of Failing infrastructure at Brampton outfall along the west humber.	Claireville North Oxbow Wetland restoration. (Continue restoration of large impacted wetlands previously drained by farming practices in Claireville)	2021 -2022 Begin Treatment of woody invasives through main CA.	Native Seed purchased from Native Plant Source and St. Williams (Southern Ontario). Development and adoption of approved TRCA seed mixes and cover crops.
Reforestation of Large Areas of CCA.	Valley Creek Wetland and IRT development. Manage slope runoff and improve area impacted from historic farming and development	Continue Treatment into 2023.	Planting Plan species selection (Primarily focus on use of species adapted to early successional growth)
Bioengineering along stream sections	Wet 'N" Wild Wetland. Improve shallow water flow path habitat from driving range drainage	Expand Scope to include treatment of DSV, Phragmites, chipping of buckthorn in 2023.	Use data and mapping (Vernal Pools) for wetland restoration and Riparian Plantings. Targeting gaps in the canopy/distance to wetlands to improve structural diversity and connectivity through CCA

Bramelea Natural Channel Project



- Eastbourne Park is the first section in the Bramalae EcoPark Project to be restored
- By 1989, the area surrounding the project site was fully developed and the channel had been hardened with little to no natural cover.

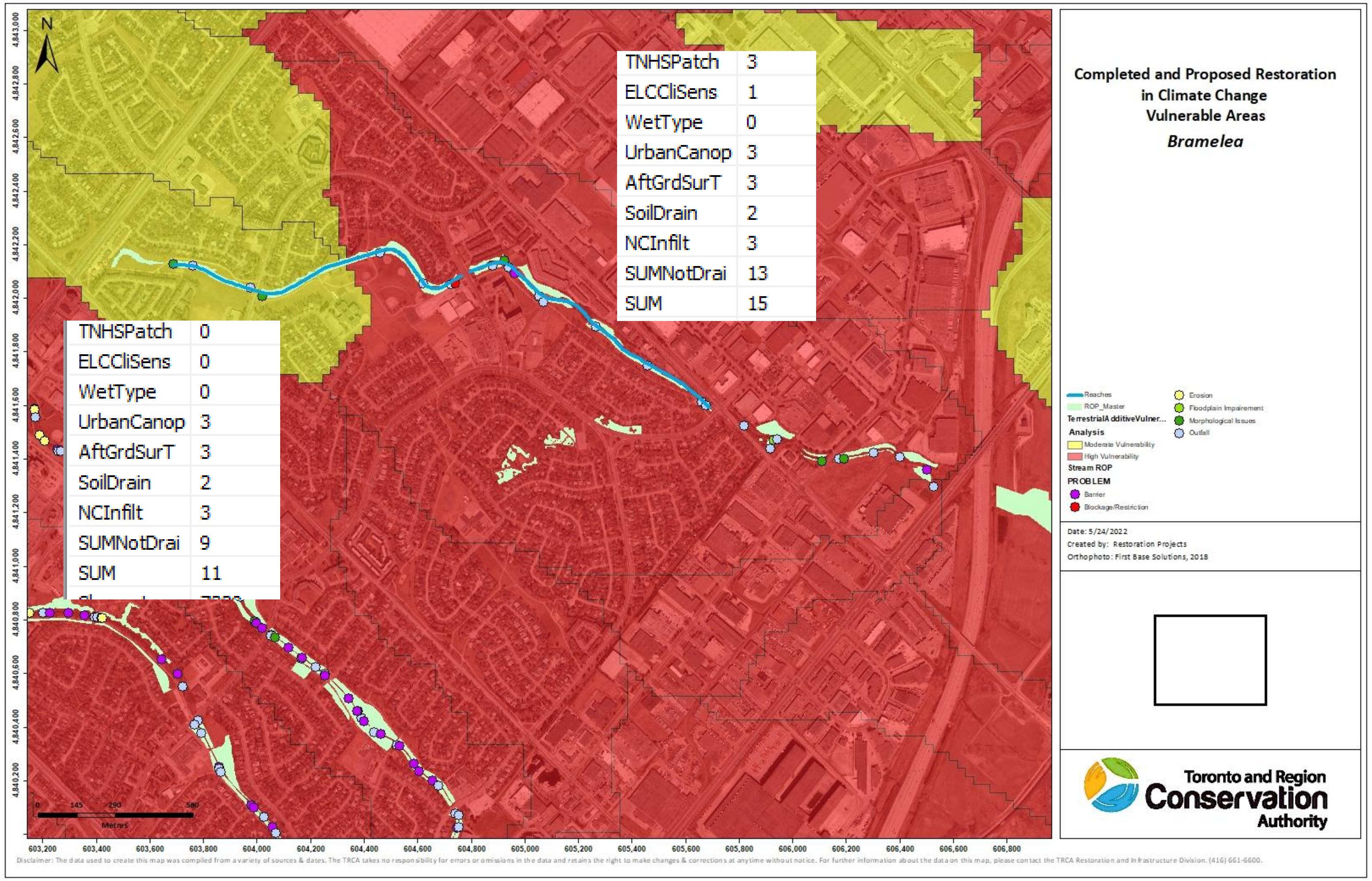
Existing Conditions

- Eastbourne Park is approximately **8.4 ha** of linear open space with approximately **1 km** reach of Mimico Creek forming a central spine through the park.
- One pedestrian bridge crossing in Eastbourne Park, adjacent trail system and playground areas.
- The channelized watercourse originates from a sewer outfall in Fallingdale Park (upstream) , and the bed and portions of the banks have been hardened with concrete, which is failing in many locations.
- Multiple stormwater outfalls discharge directly to the watercourse throughout the parks.
- Narrow band of natural vegetation along the channel margins.
- The surrounding area is predominantly open manicured greenspace with scattered trees.
- The site is bounded by low density residential homes, commercial areas, and institutional buildings (i.e., Eastbourne Drive Public School,).





Terrestrial Vulnerability Additive Analysis (Catchments) - Bramelea

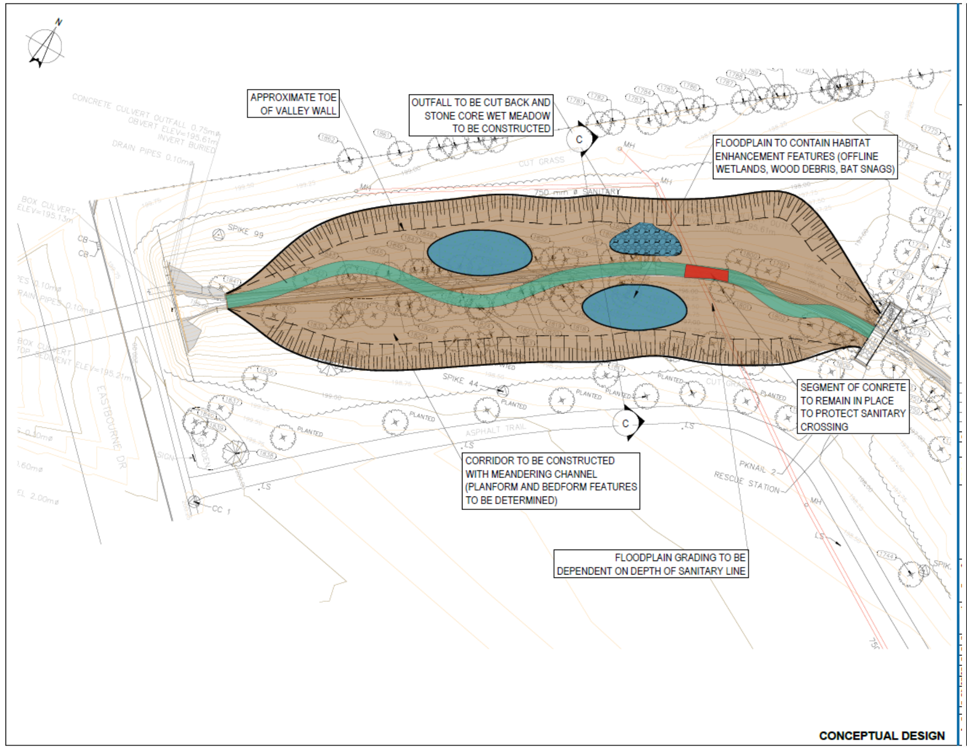


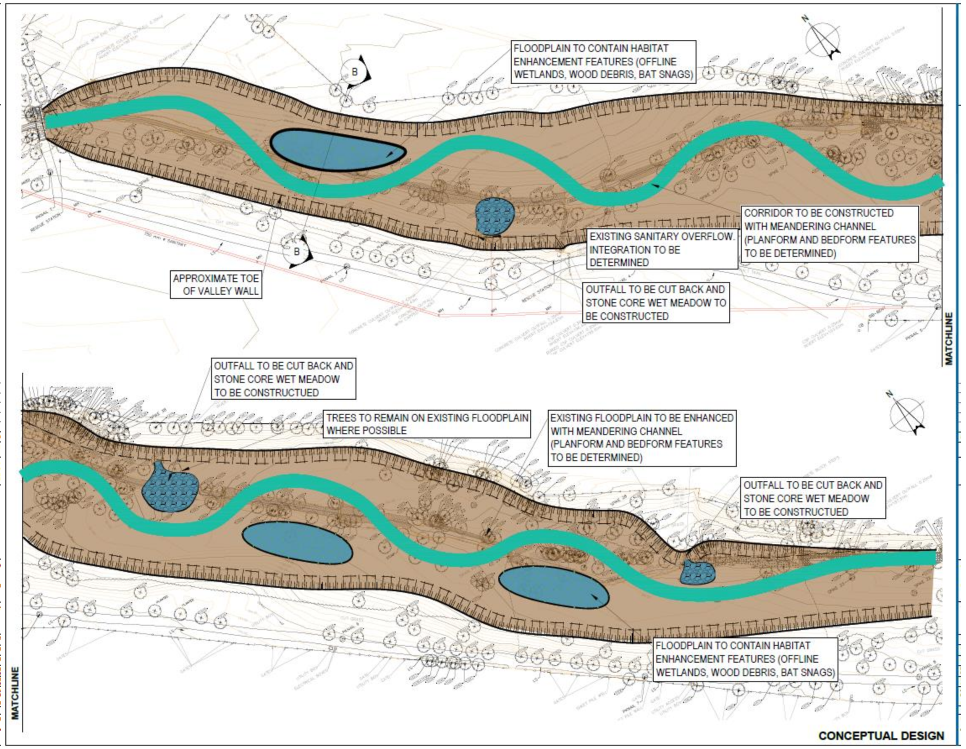
Climate Change Vulnerabilities

Vulnerability Indicator	Vulnerability Indicator Score	Applicability and Reccomendation
Water Temperature	Absolute maximum biological tolerance threshold for cold-(26˚C), cool-(28˚C) and warm-water systems(30˚C), respectively.	Increased maximum stream temperatures caused by climate change should be considered in channel design and restoration to avoid further or future loss of native fish species.
Natural Cover	the BSA has been assessed as having a vulnerability indicator score of high for Natural Cover (Infiltration)	Natural cover within and adjacent to the BSA can act to mitigate impacts of climate change
Recharge	The BSA has been assessed as having a vulnerability indicator score of high for Recharge.	As the BSA is situated within a heavily urbanized area, coupled with imperfect soil drainage. Design considerations needed to promote Infiltration (Floodplain connectivity, removal of impervious surfaces, LID)
Land Surface Temperature	Vulnerability scores for land surface temperature within the BSA in the were moderate(25˚C–29˚) for mid-morning and high (>36˚C) for mid-afternoon.	As natural forest and urban canopy is low within and surrounding the BSA, shade and thermal refugia are limited. Existing paved surfaces and infrastructure exacerbate increased land surface temperatures. Design considerations needed to reduce surface temp.
Habitat Patch Quality	Patch analysis for the BSA contains lower quality habitat patches (L4-L5), with limited natural cover, leading to a vulnerability indicator score of high	Habitat quality for the BSA was assessed as low and connectivity is limited to small riparian corridors along urban streams. Design should increase connectivity to existing habitat patches.
Urban Canopy	The BSA has been assessed as having a vulnerability indicator score of high for Urban Canopy.	Urban forest cover is limited within the BSA, with most trees being located as a small riparian corridor along the two watercourses or as a buffer along residential/commercial land-use. Design should increase urban canopy through native three and shrub planting

Design Alternatives – Alternative #5
Meandering Channel and Widened Floodplain

- replace concrete lined channel with natural channel
- cut floodplain to reconnect to channel and add capacity
- add floodplain wetlands
- LIDs at storm outfalls
- riparian corridor plantings





Highlights Addressing the BMPs

Protect Aquatic Refugia Habitats	Protect and Restore Shallow Water Flow Paths	Invasive Species Management	Increase Specie, Genetic, Structural Diversity to Promote Climate Resilience
Riparian Planting	Floodplain connectivity	Mapping of Invasive species in corridor	Use of Locally adapted Trees and shrubs from TRCA nursery in reforestation, riparian, wetland, projects. Other nurser y's (St. Williams, CVC, Summerville)
Riffle: pool habitat	Restore floodplain wetlands	DSV, Phragmites and buckthorn present on site	Native Seed purchased from Native Plant Source and St. Williams (Southern Ontario). Development and adoption of approved TRCA seed mixes and cover crops.
Removal of barriers	Removal of impervious infrastructure	Invasive treatment and management	Corridor connectivity to fragmented habitats
LIDs. Wetlands at outfalls	LIDs to promote infiltration and reduce sediment	Monitor and adaptive management	Riparian Plantings are targeting gaps in the canopy, floodplain wetlands added to improve structural diversity and connectivity

Jordan Jefferson Jayfield Parks Natural Channel Project

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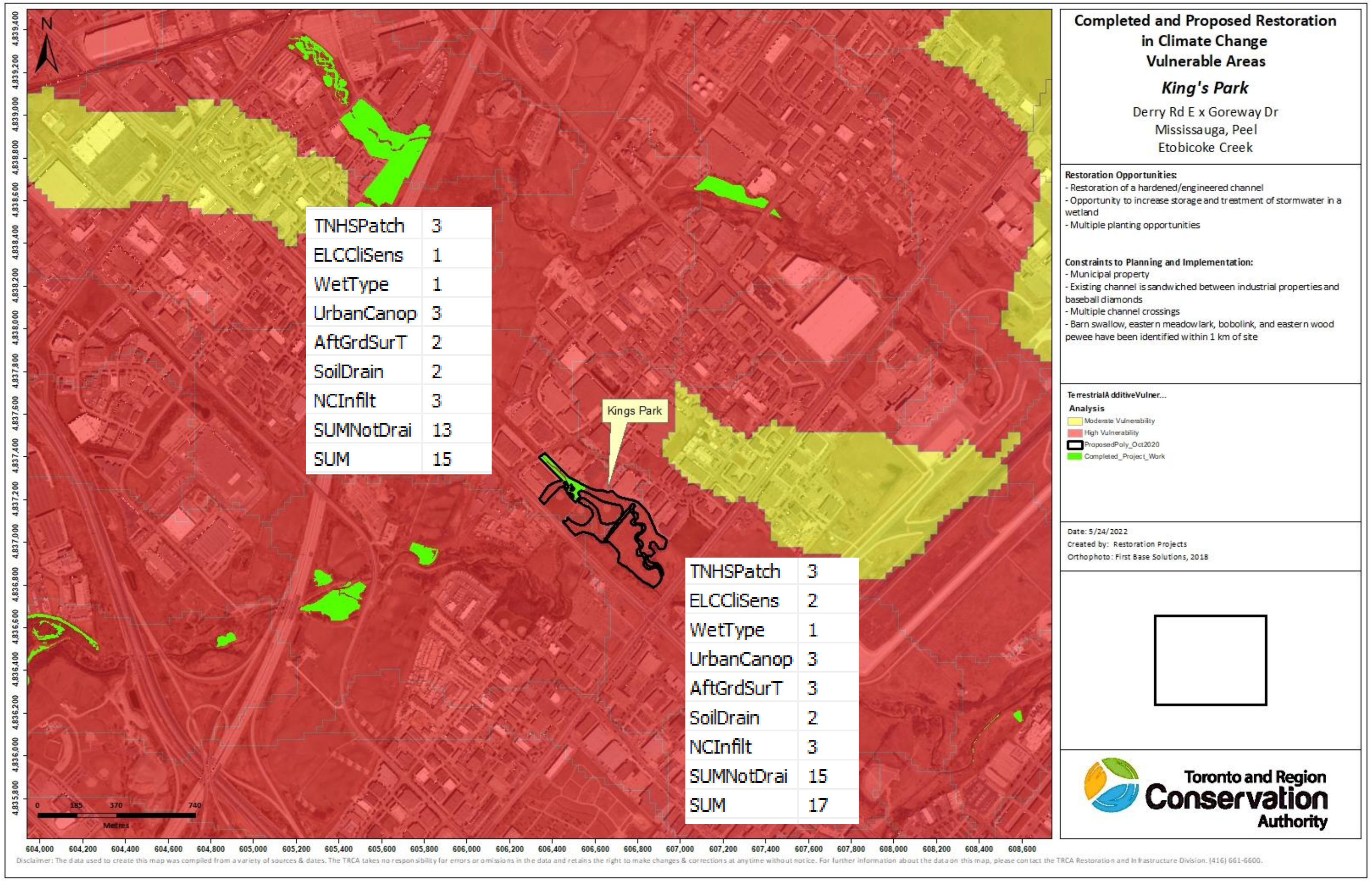
Kings Park Stream Restoration Project

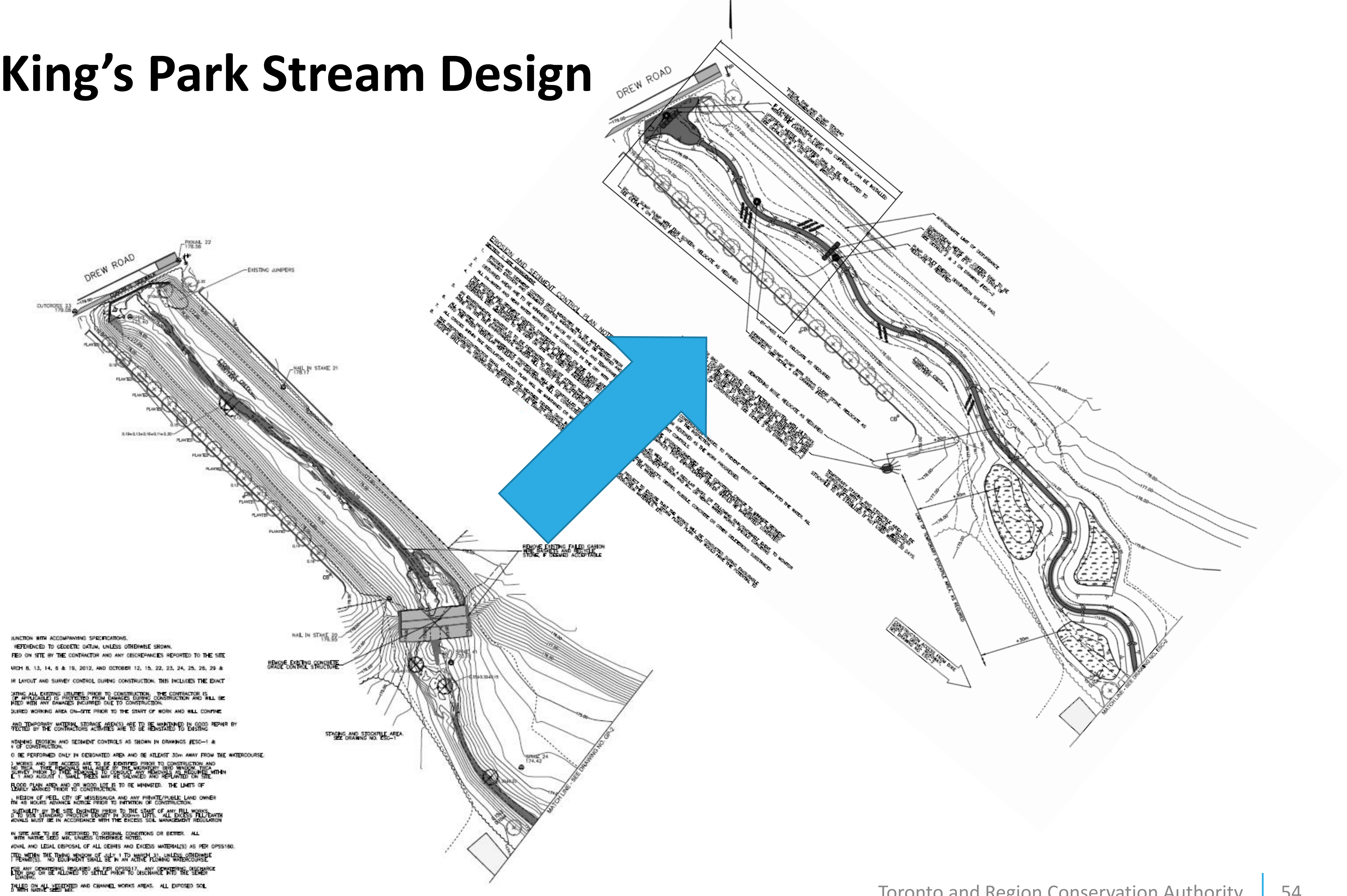
Terrestrial Vulnerability Additive Analysis (Catchments)-Kings Park



Kings Park Stream Restoration Project

Kings Park Stream Restoration Project

King’s Park Stream Design



Kings Park Stream Restoration Project

350 m stream restored (trib of Etob Crk)
2 barriers mitigated
Opened 9.5 km of creek
1 ha planted
2085 trees and shrubs planted
10,800 bio stakes Click to add text

Kings Park Stream Restoration Project

Highlights Addressing the BMPs

Protect Aquatic Refugia Habitats	Protect and Restore Shallow Water Flow Paths	Invasive Species Management	Increase Specie, Genetic, Structural Diversity to Promote Climate Resilience
Riparian Planting	Floodplain connectivity	Mapping of Invasive species in corridor	Use of Locally adapted Trees and shrubs from TRCA nursery in reforestation, riparian, wetlan d, projects. Other nursey (St.Williams, CVC, Summerville)
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Removal of barriers	Removal of impervious infrastructure	Invasive treatment and management	Corridor connectivity to fragmented habitats
Floodplain wetlands	promote infiltration and reduce sediment inputs	Monitor and adaptive management	Riparian Plantings are targeting gaps in the canopy to improve structural diversity and connectivity. Wetlands added to floodplain add connectivity.

Upcoming ECS Lunch and Learns!

Wednesday, June 15
11:00am-12:00pm

Etobicoke Creek Water Quality Modelling

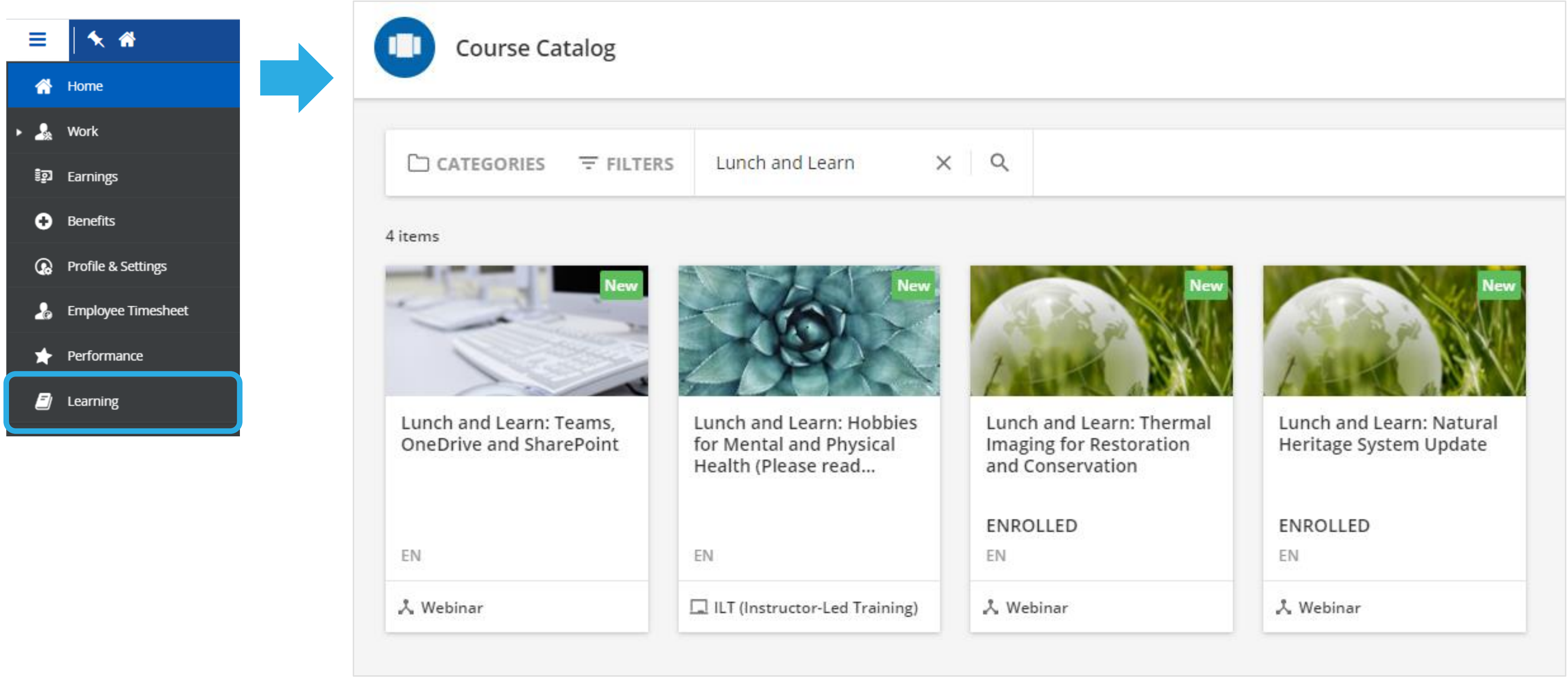
By Bhaswati Mazumder (TMU), Lyndsay Cartwright and Krista Chomicki

July, TBC

TRCA Trail Strategy Implementation

By Corey Wells

Learning Management System



Scientific Knowledge Sharing Hub

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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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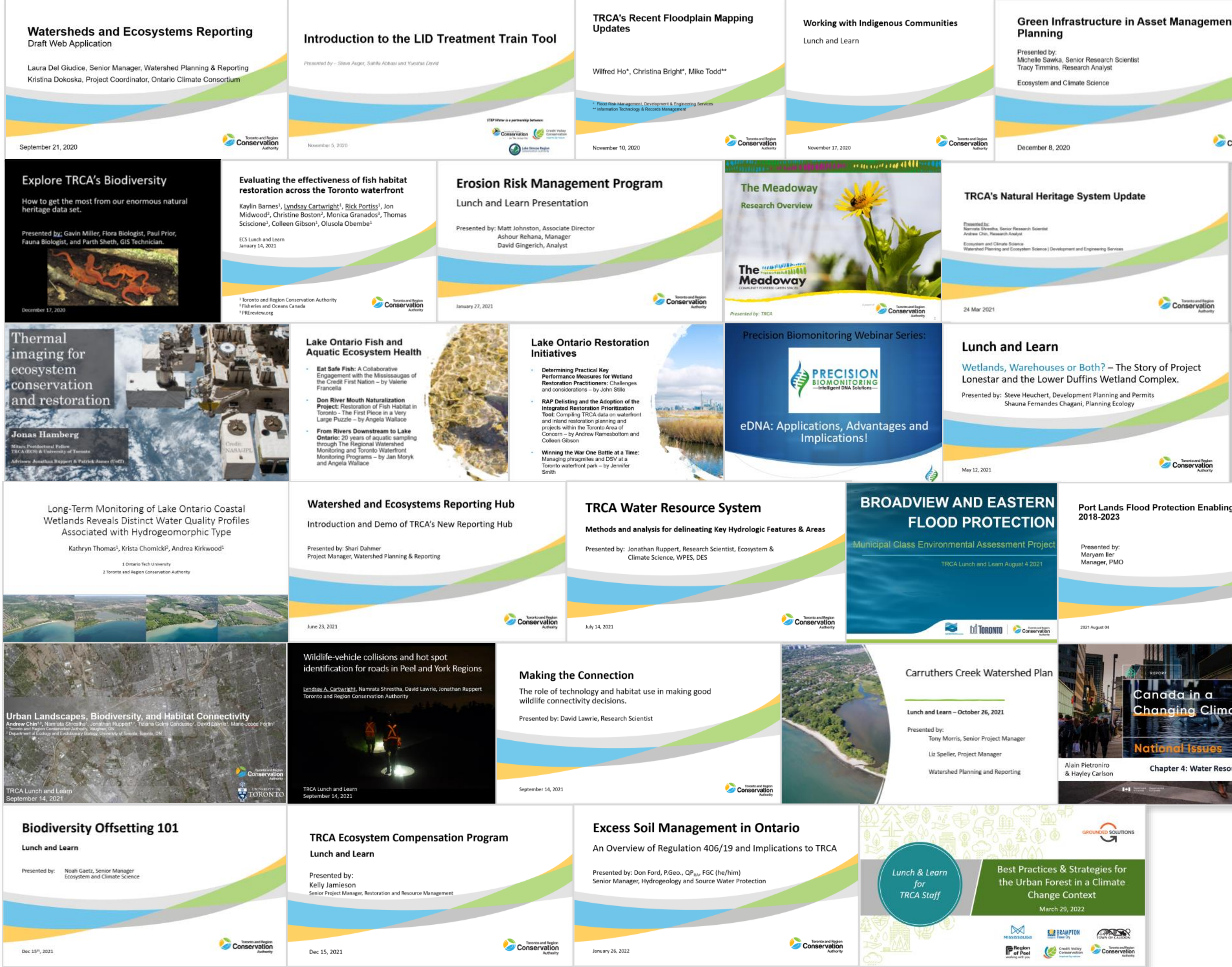

Thank you

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

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sharon.lam@trca.ca