Credit Valley Conservation
inspired by nature

Climate Change Considerations for Management of Natural Features

STEP Webinar Series
June 2, 2022

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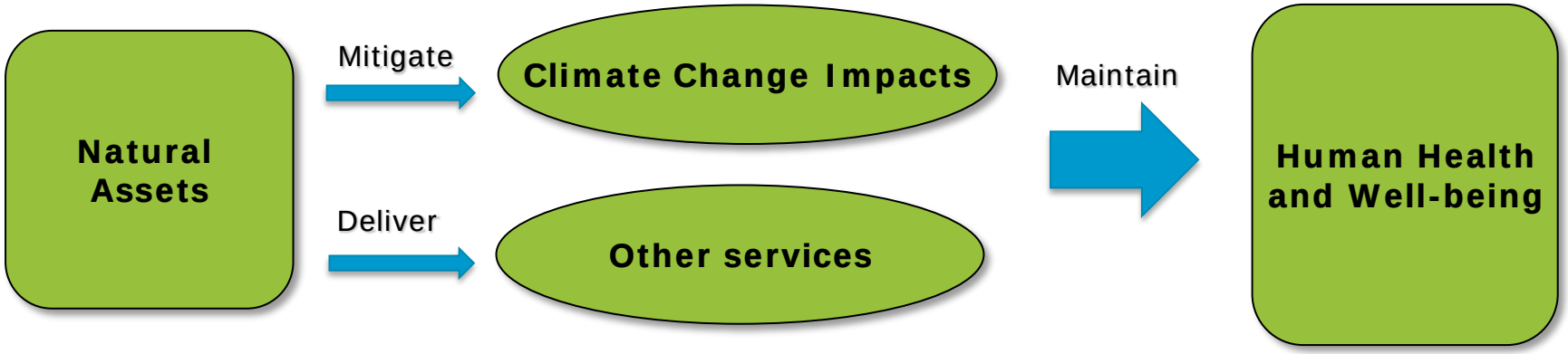
On behalf of the CVC Ecology & Monitoring Division

Climate Change: A Risk Business……

Photo: Rob Bieber

Role of Natural Assets in Addressing Climate Change



Mitigation of Climate Change Impacts	Delivery of Services
• Carbon sequestration and storage • Stormwater management • Urban heat island reduction	• Recreation and tourism • Waste assimilation • Real estate value appreciation • Drinking water quality enhancement

- **Physical**
- **Mental**
- **Social**
- **Economic**

Natural Heritage System Protection and Climate Resilience

Protecting and restoring the natural heritage system is one of the most important climate change actions we can undertake for local ecosystems.

2022 STEP Webinar Series

- March 31 – Overview of the Ecological Land Classification System
- April 7 – Natural Asset Inventory and Condition Assessment (Part 1)
- April 28 – Fish and Wildlife Passage at Bridges and Culverts
- May 5 – Level of Service, Valuation and Life-Cycle Costing for Natural Assets (Part 2)
- June 2 – Climate Considerations for Management of Natural Features
- June 23 – CVC Ecosystem Offsetting Guidelines
- September 8 – Building Business Case for Natural Assets (Part 3)
- September 29 – Biodiversity Matters in Managing Natural Assets

https://sustainabletechnologies.ca/events/2022-webinar-series/

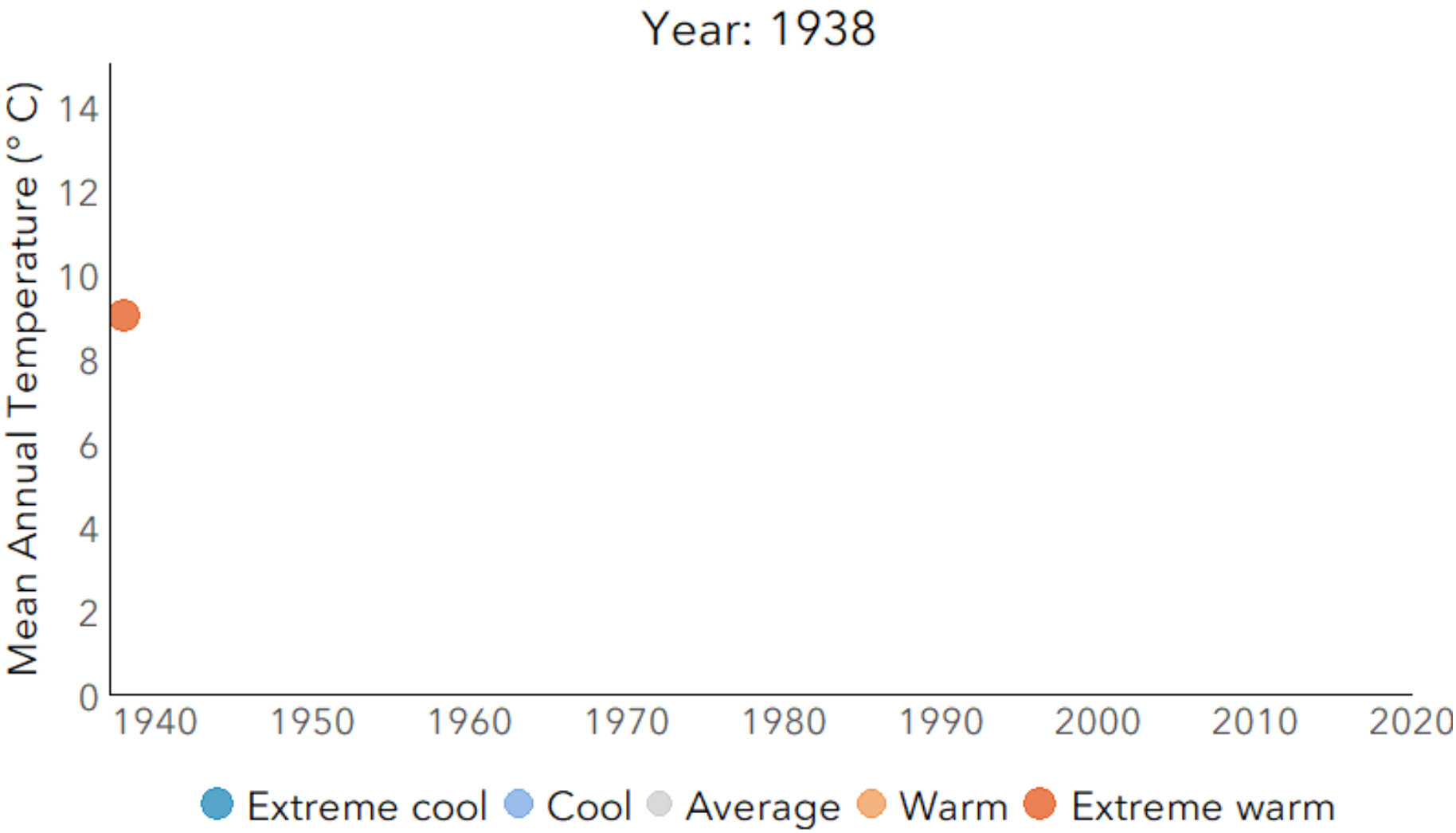
Outline

- How has climate changed across the watershed?
- What impacts have we seen in response to climate change?
- What does the science tell us we need to do?
- What is CVC doing to address this challenge?

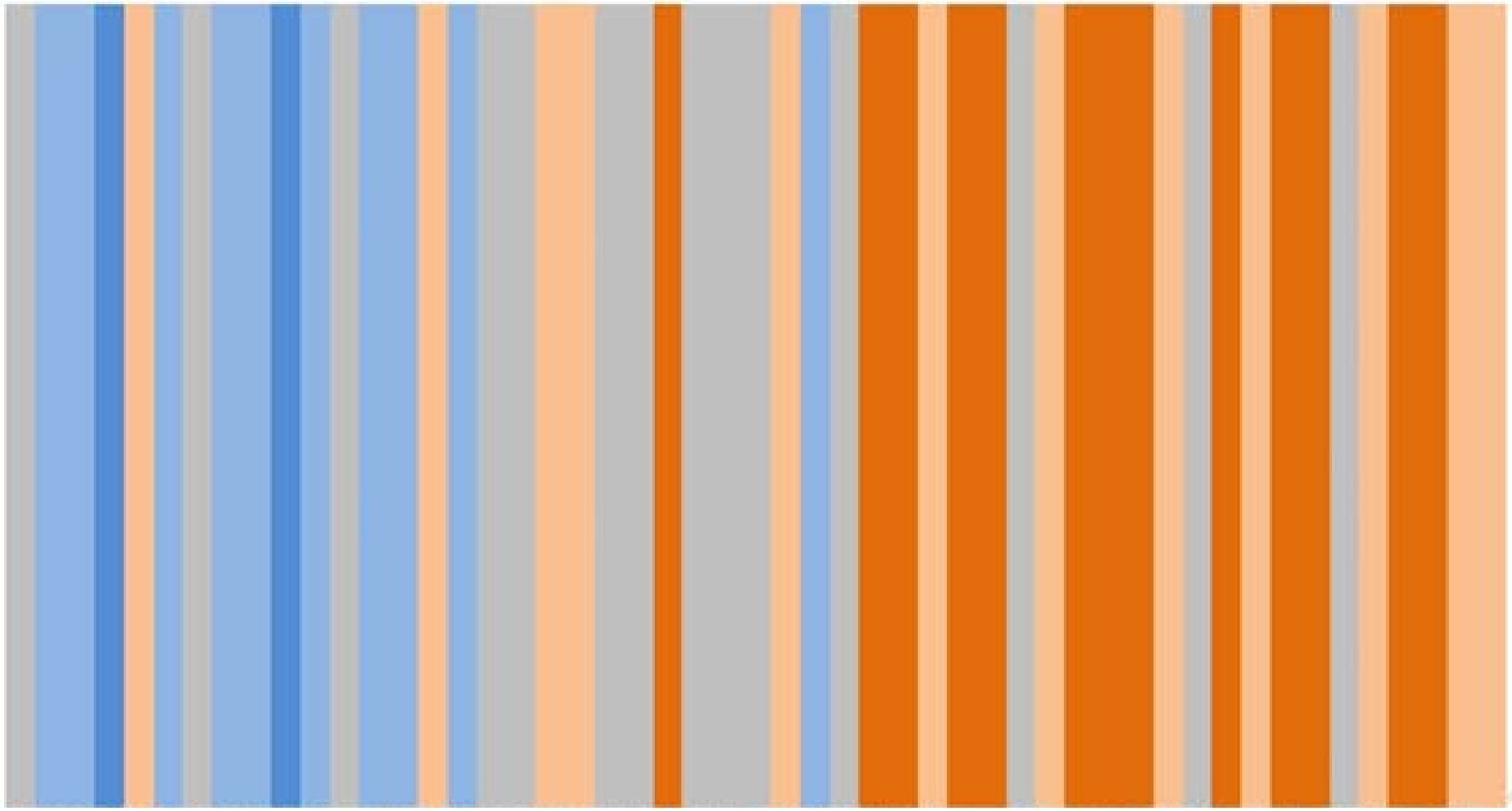
How Has Climate Changed Across the Watershed?

Warming Climate

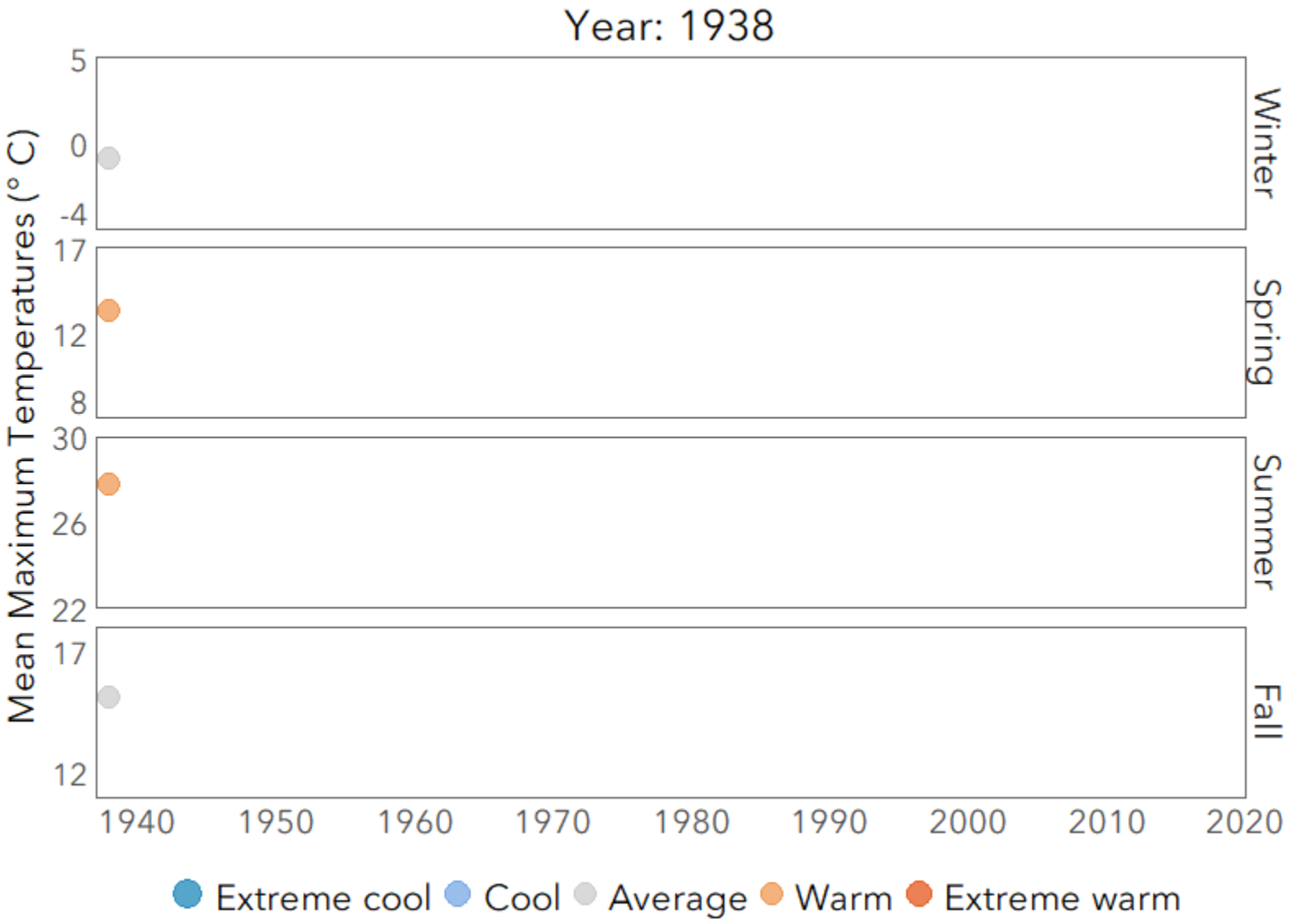
Metric	Trend	Overall Change
Average temperature	↑	1.8 °C
Minimum temperature	↑	2.5 °C
Maximum temperature	↑	1.1 °C
Absolute maximum	↔	-
Absolute minimum	↑	4.0 °C
Extreme heat days (>30°C)	↔	-
Extreme cold days (<-10°C)	↓	-12.0
Cooling degree days	↑	10.0
Frost-free days	↑	14.0



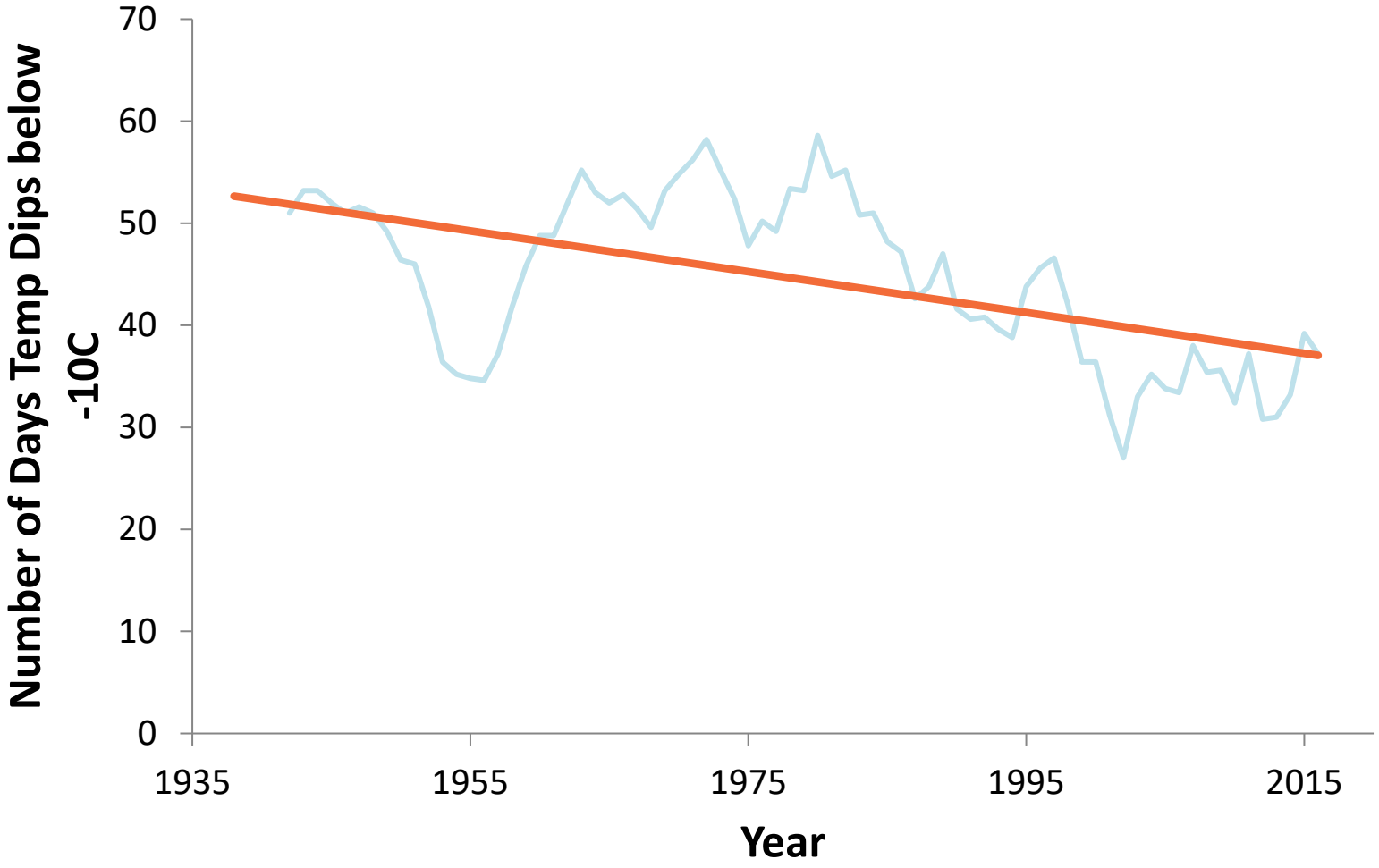
Average annual temperature has increased by 1.8ºC



Consistent warming from 1990 to the present



Winters warming faster than other seasons



Number of days temperature dips below -10°C decreased by 14 (51 to 37 days)

Growing season 40 days longer.
Air conditioning on 14 days longer.

Wetter Climate

Metric	Trend	Overall Change
Total precipitation	↑	6% (50 mm)
Precipitation in the form of rain	↑	13%
Maximum one-day precipitation	↔	-
Snow Depth	↓	-53%
Snow water equivalent	↓	-32%

Total annual precipitation increased by 6% in lower watershed and 23 % in upper watershed

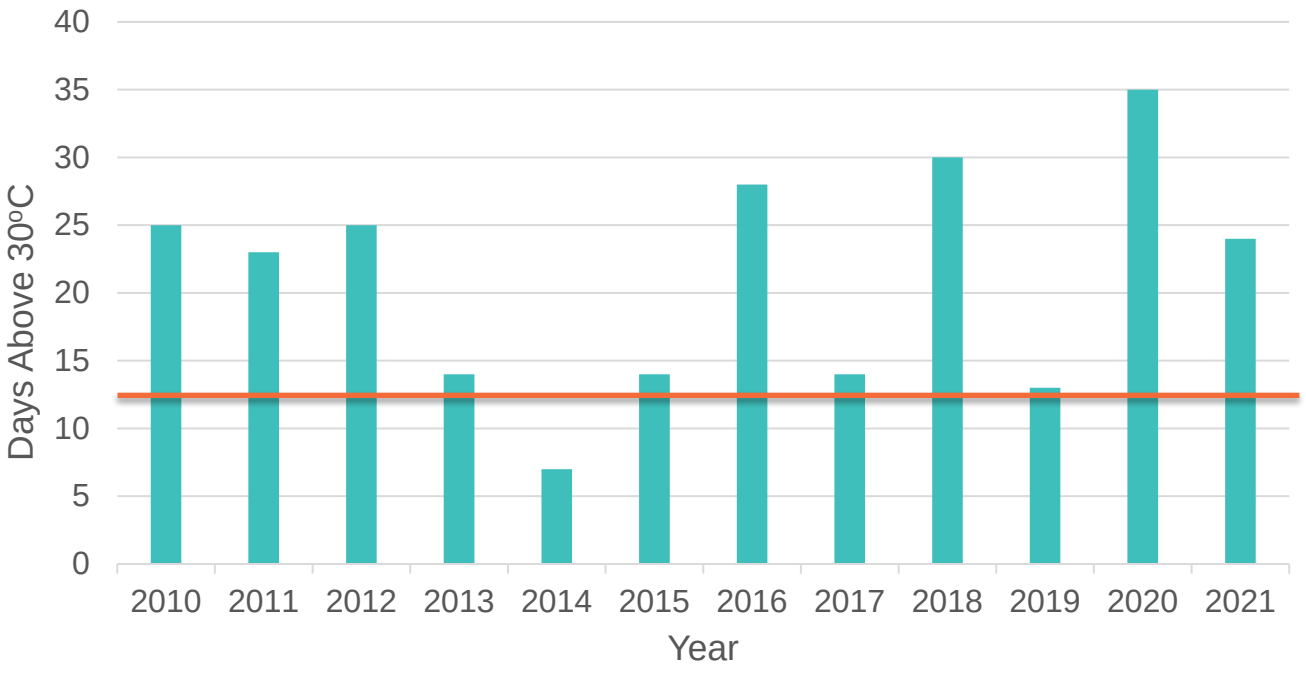
Less snow: 13% more precipitation in the winter is falling as rain. Snow depths decreased by 53%.

Recent Extreme Events - A Look Into the Future?

Flood Events Due to Summer Storms: 2013 and 2017

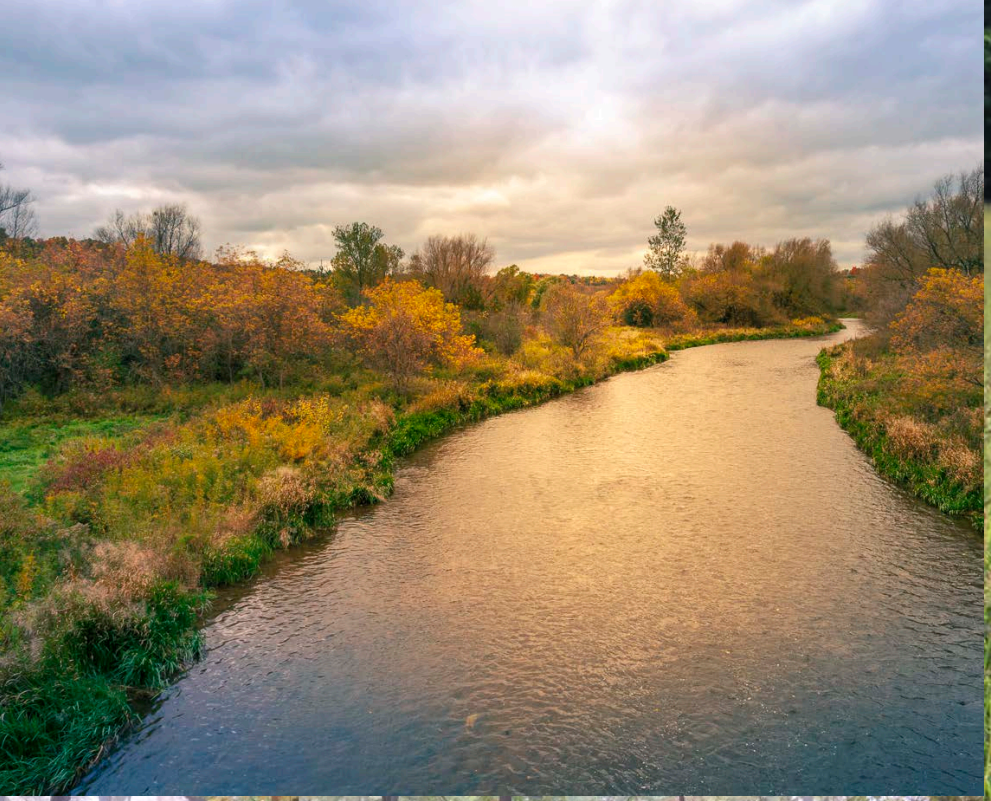
Ice Storms: 2013 and 2018

Wind Storms: 2018 and 2022



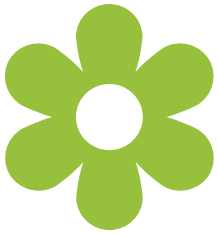
Extreme Heat: 2010 to 2021

What Impacts Have We Seen in Response to Climate Change?




Multiple Stressors

Urbanization

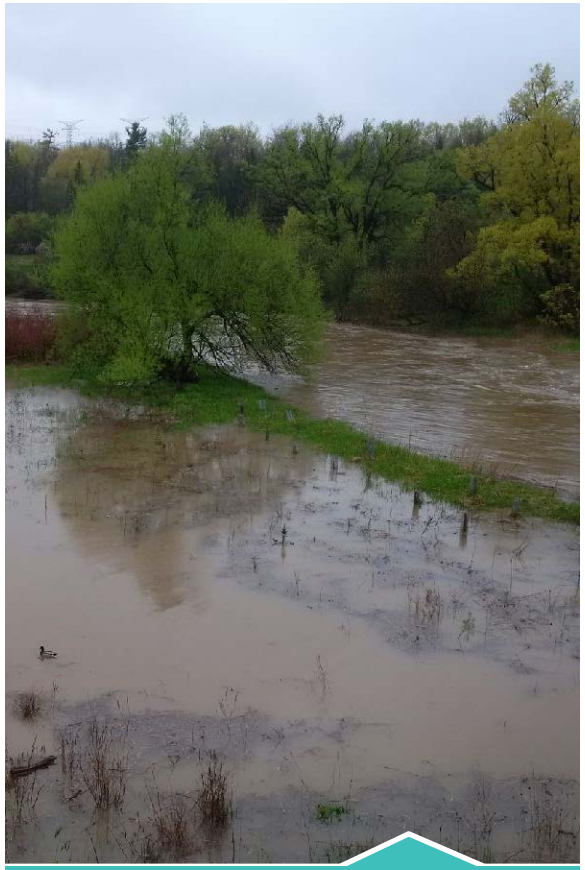


Invasive species

Water taking

Dams and online ponds

Climate Change Impacts



Increasing stream flows

Average Annual Flows

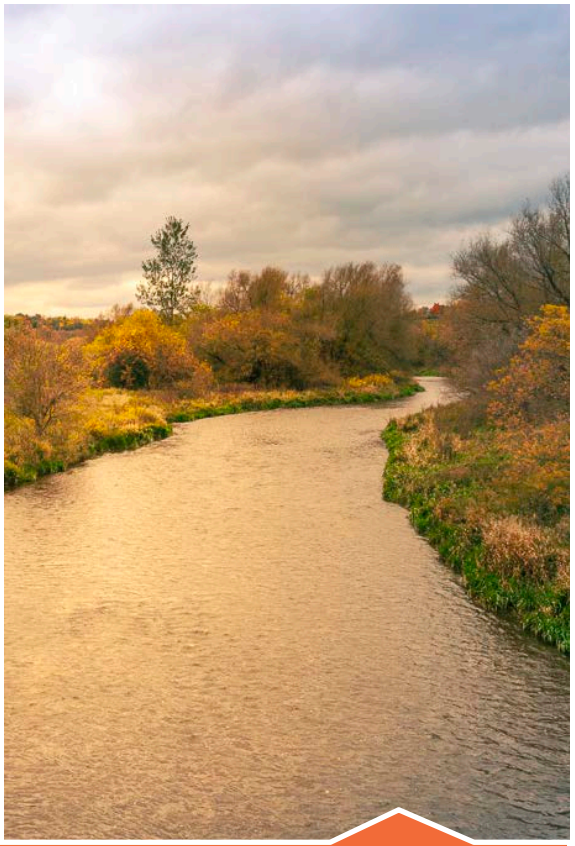
+ 67%

Largest increases in May, Jun, Jul

March flows

- 31-89%

Climate Change Impacts



Warmer stream temperatures

Mean Daily Maximum

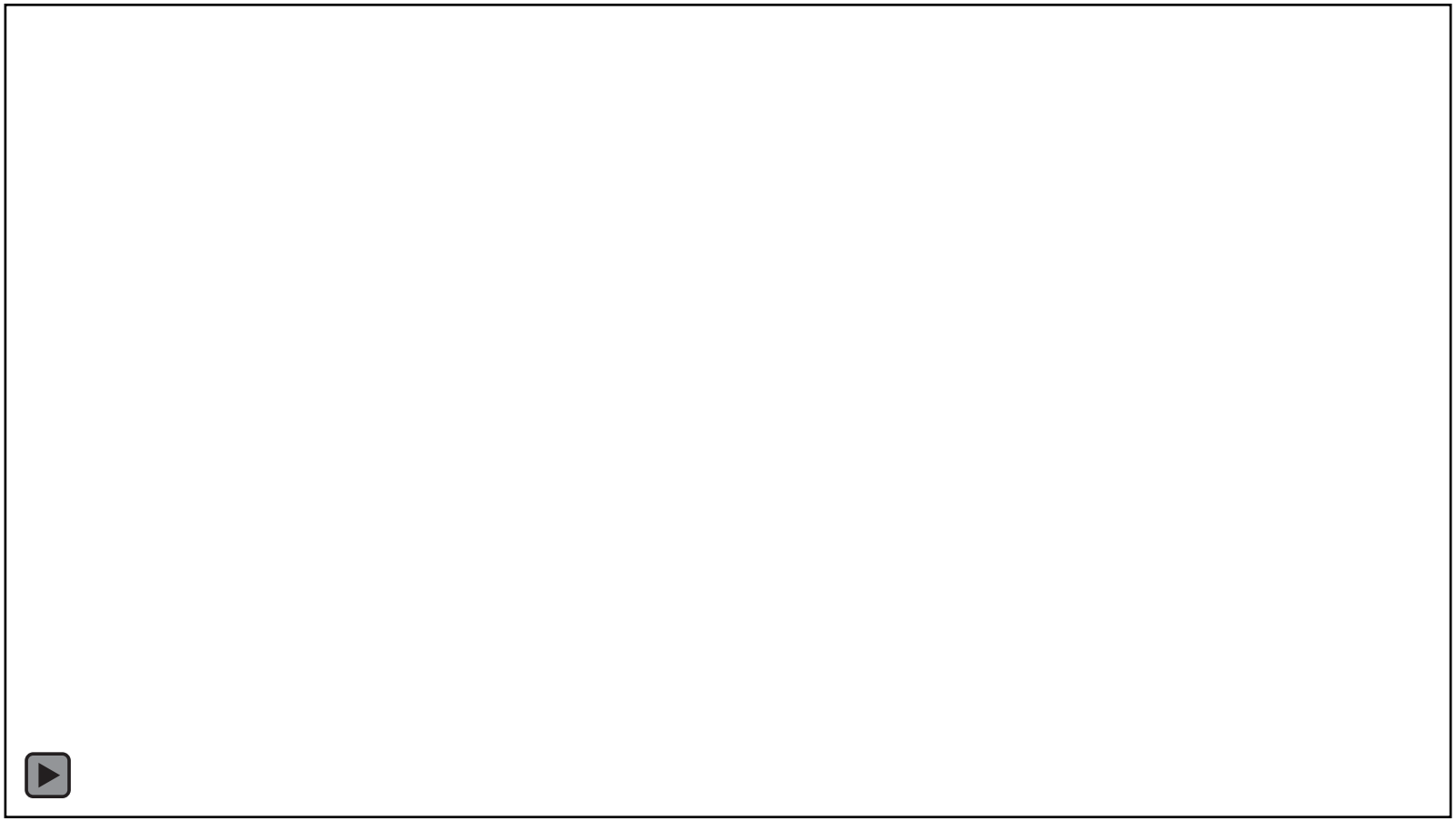
+ 0.5 ^{o}C

Maximum Weekly Average

+ 0.8 ^{o}C

Cumulative Degree Days

+ 15%



Warming stream temperatures threaten coldwater fish species

Algal Blooms

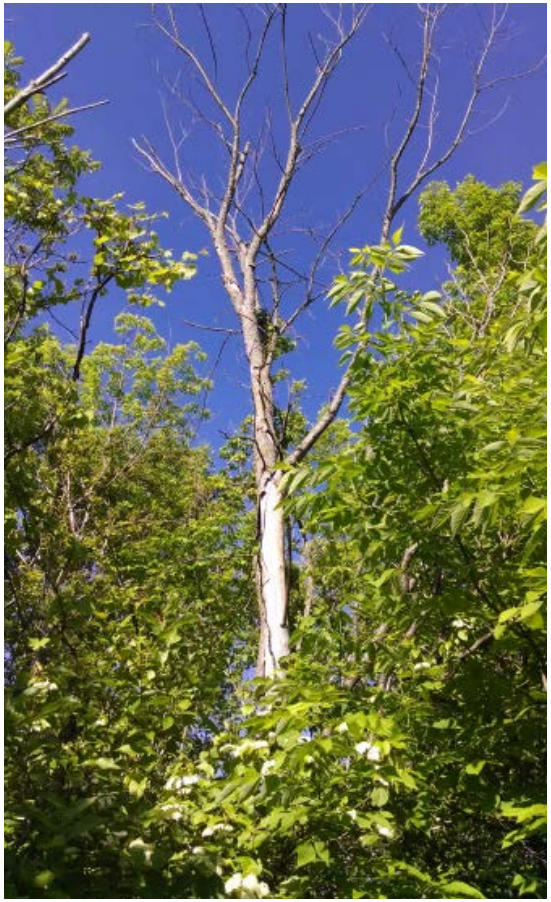
Climate Change Impacts

Increase in pest and disease outbreaks

Beech Scale

Emerald Ash Borer

Spongy Moth



41% of ash trees are infected by the emerald ash borer (EAB)

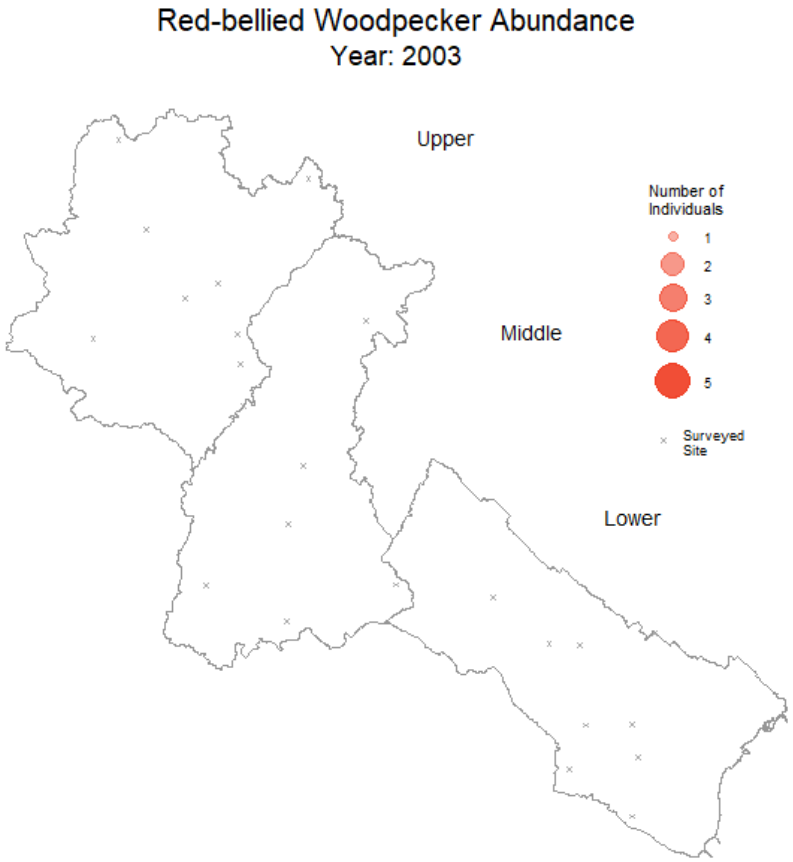
92% beech trees show signs of beech bark disease

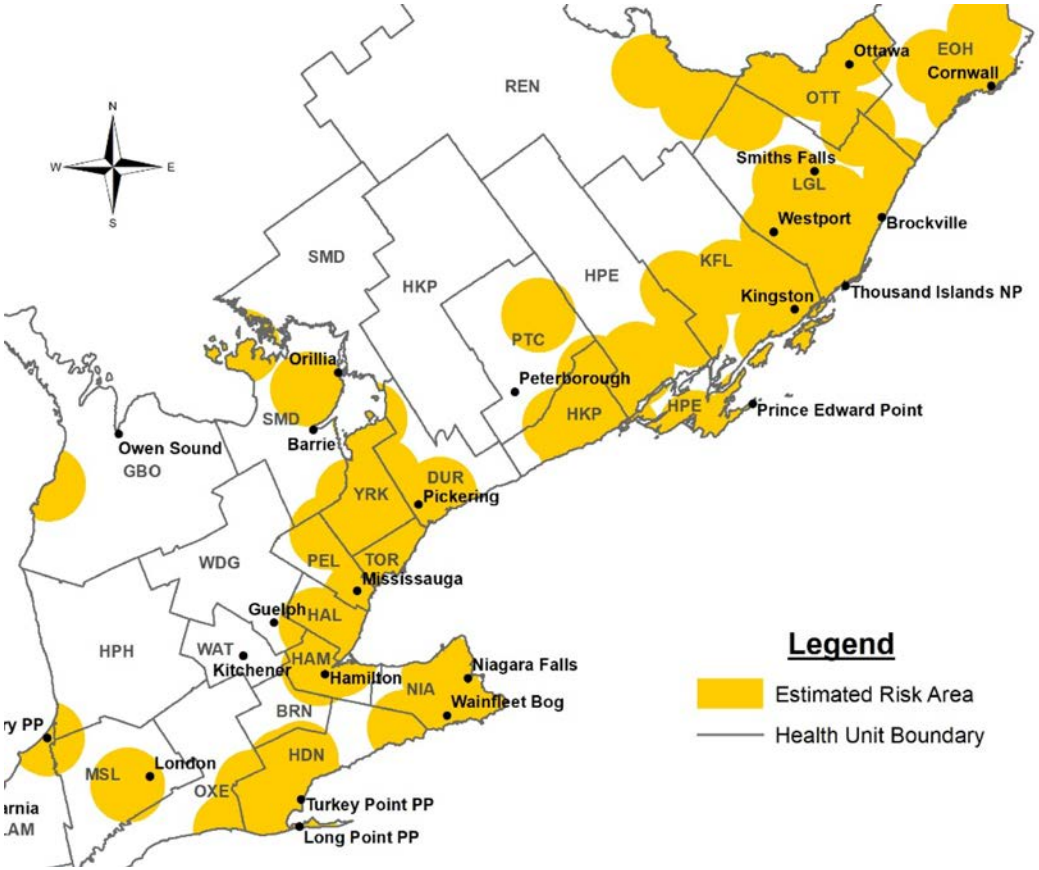
13% of forest trees have signs of decay like fungus and cankers

Ranavirus outbreak causing mortality event in frog and minnows at two locations

Climate Change Impacts

More abundant southern species





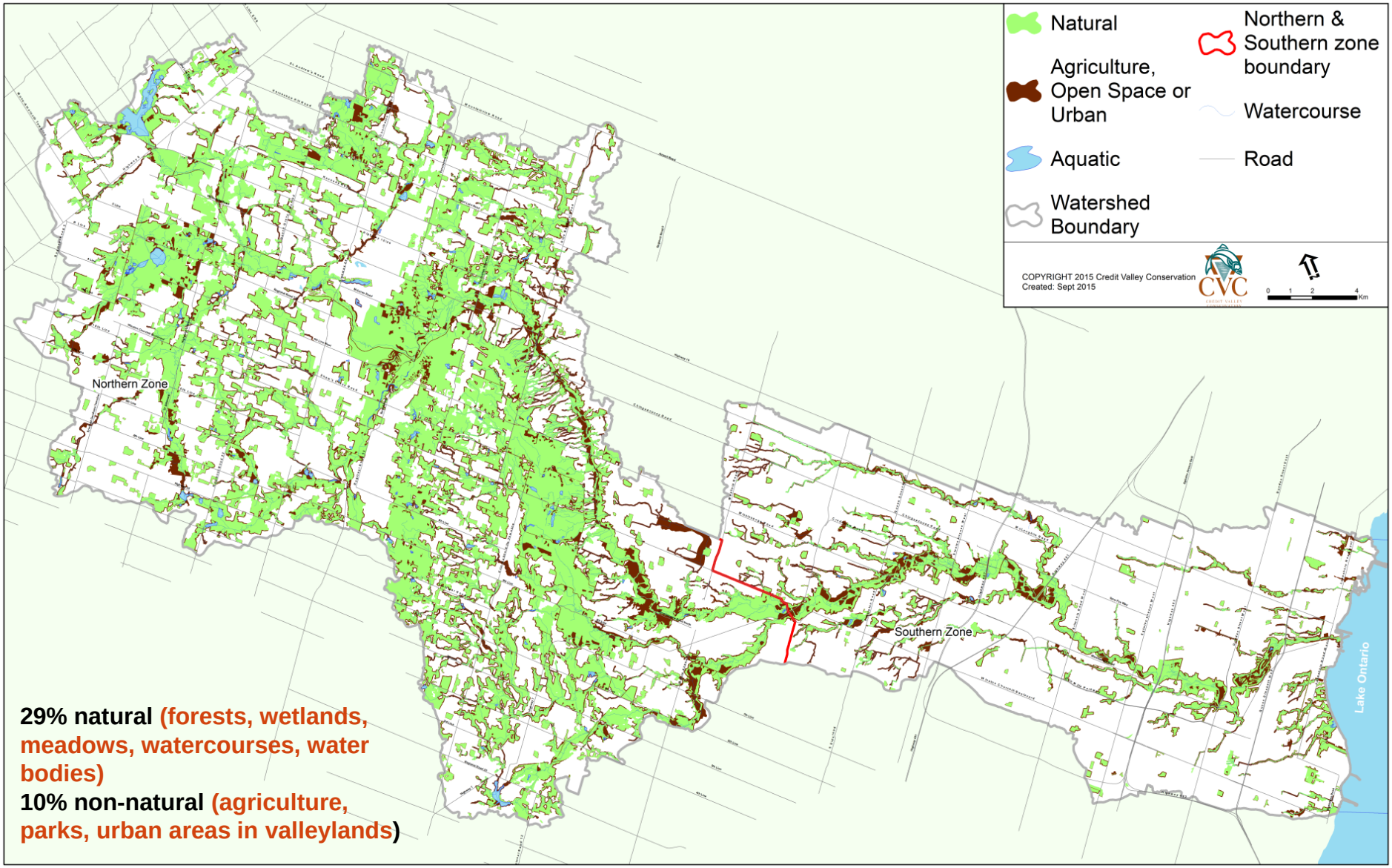
Peel is in a high-risk area for tick exposure

Managing the Natural Heritage System through a climate lens

What is a Natural Heritage System?

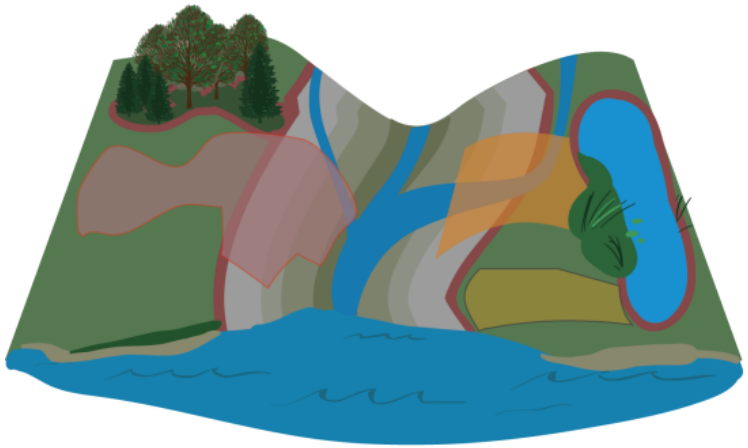
"A system made up of natural heritage features and areas, and linkages intended to provide connectivity…and support natural processes."

- Provincial Policy Statement 2020



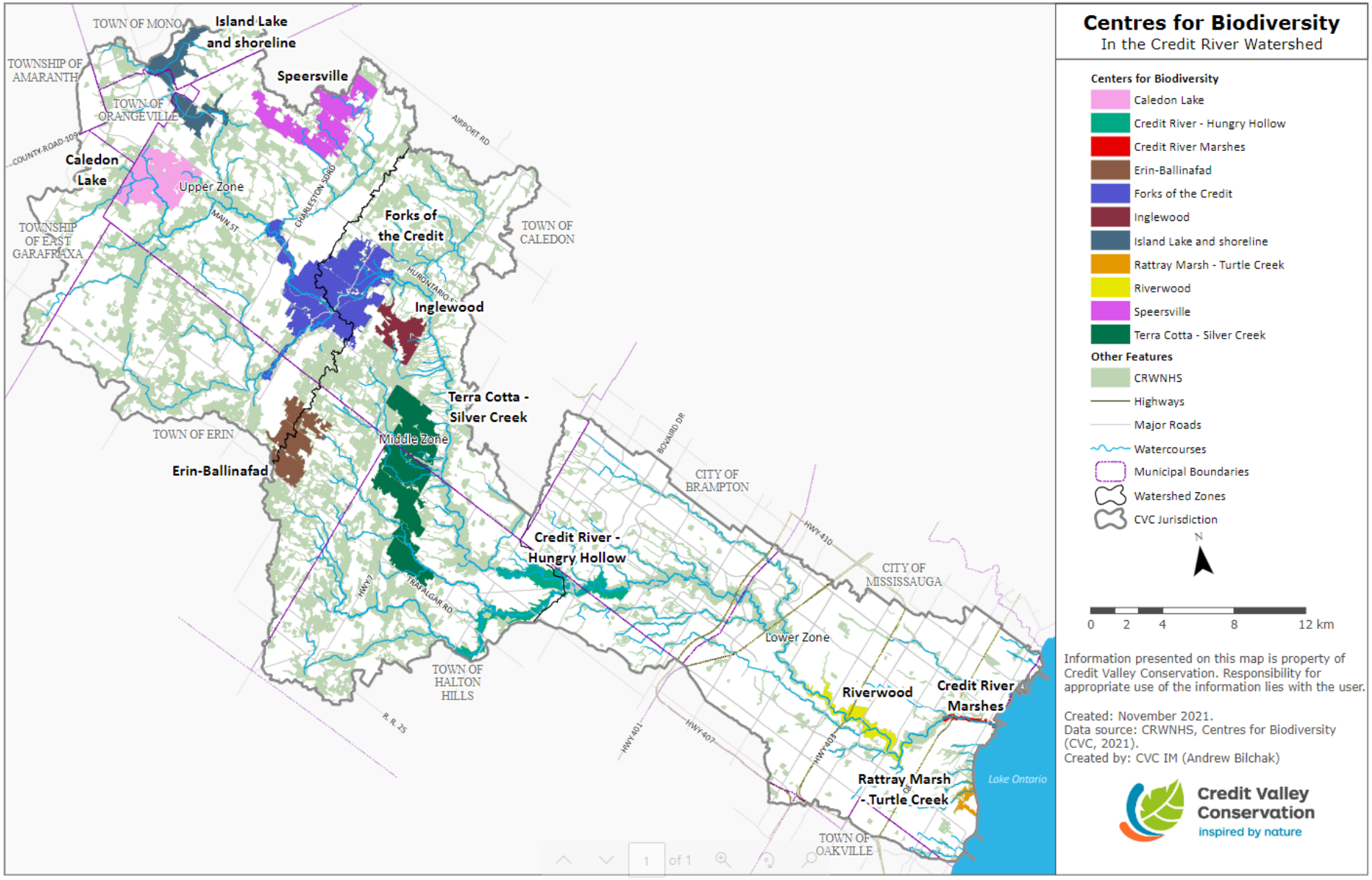
Credit River Watershed Natural Heritage System (NHS)

Overview: Building blocks of the system



Credit River Watershed
Natural Heritage System

1. Valleylands
2. Wetlands
3. Woodlands
4. Aquatic habitat (watercourses and water bodies)
5. Lake Ontario shoreline
6. Significant wildlife habitat
7. Habitat of endangered species & threatened species
8. Buffers
9. Centres for Biodiversity



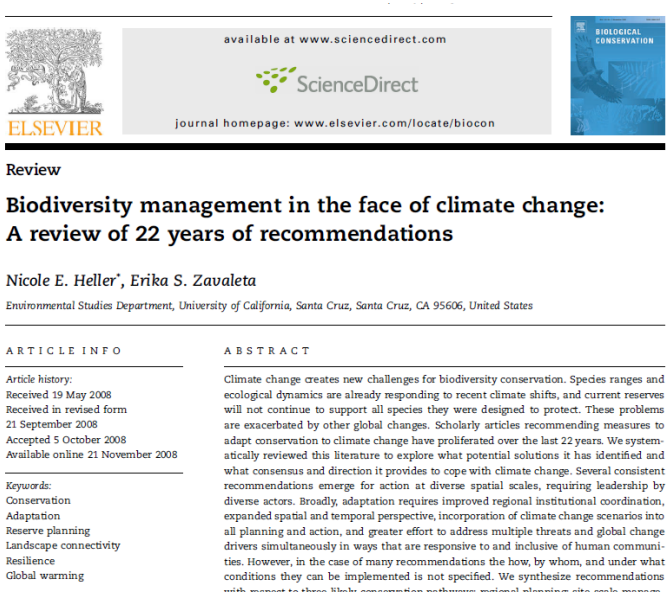
Centres for Biodiversity

Watershed Wide Targets

Parameter	Watershed target	Current Status (2021 ELC)	Fully Restored NHS
Woodland cover	30% - 40%	23%	33%
Woodland Interior	10% or greater	3%	6%
Large woodland patches (>200 ha)	At least one; preferably several	10	33
Wetland cover	10.4%	7%	7%
Riparian cover	90% length natural, with a 30 m buffer on each side	75%	91%
Valleyland natural cover	90%	76%	91%

Are you undertaking actions that help ecosystems adapt to climate change?

Protecting and restoring natural heritage systems and **increasing connectivity** is the top biodiversity management recommendation through a climate change lens



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Review

Biodiversity management in the face of climate change: A review of 22 years of recommendations

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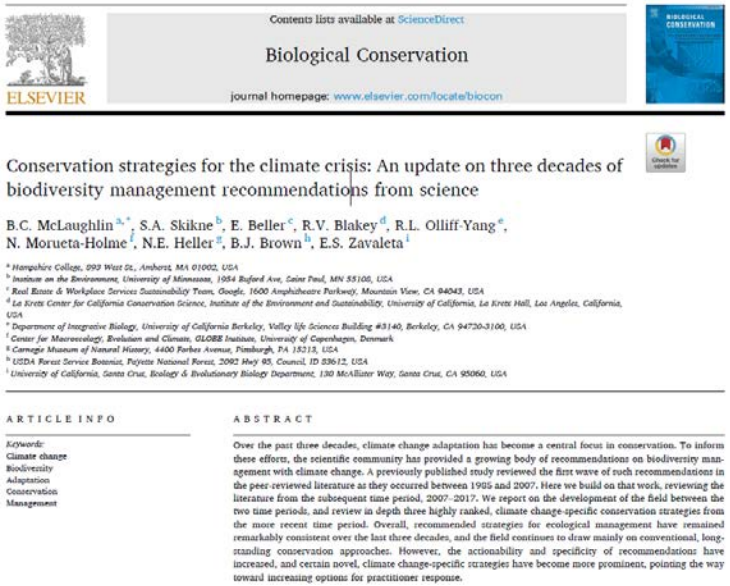
ABSTRACT

Climate change creates new challenges for biodiversity conservation. Species ranges and ecological dynamics are already responding to recent climate shifts, and current reserves will not continue to support all species they were designed to protect. These problems are exacerbated by other global changes. Scholarly articles recommending measures to adapt conservation to climate change have proliferated over the last 22 years. We systematically reviewed this literature to explore what potential solutions it has identified and what consensus and direction it provides to cope with climate change. Several consistent recommendations emerge for action at diverse spatial scales, requiring leadership by diverse actors. Broadly, adaptation requires improved regional institutional coordination, expanded spatial and temporal perspective, incorporation of climate change scenarios into all planning and action, and greater effort to address multiple threats and global change drivers simultaneously in ways that are responsive to and inclusive of human communities. However, in the case of many recommendations the how, by whom, and under what conditions they can be implemented is not specified. We synthesize recommendations



Contents lists available at ScienceDirect

Biological Conservation

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Conservation strategies for the climate crisis: An update on three decades of biodiversity management recommendations from science

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ABSTRACT

Over the past three decades, climate change adaptation has become a central focus in conservation. To inform these efforts, the scientific community has provided a growing body of recommendations on biodiversity management with climate change. A previously published study reviewed the first wave of such recommendations in the peer-reviewed literature as they occurred between 1995 and 2007. Here we build on that work, reviewing the literature from the subsequent time period, 2007–2017. We report on the development of the field between the two time periods, and review in depth three highly ranked, climate change-specific conservation strategies from the more recent time period. Overall, recommended strategies for ecological management have remained remarkably consistent over the last three decades, and the field continues to draw mainly on conventional, long-standing conservation approaches. However, the actionability and specificity of recommendations have increased, and certain novel, climate change-specific strategies have become more prominent, pointing the way toward increasing options for practitioner response.

Sustain & Protect

Grow

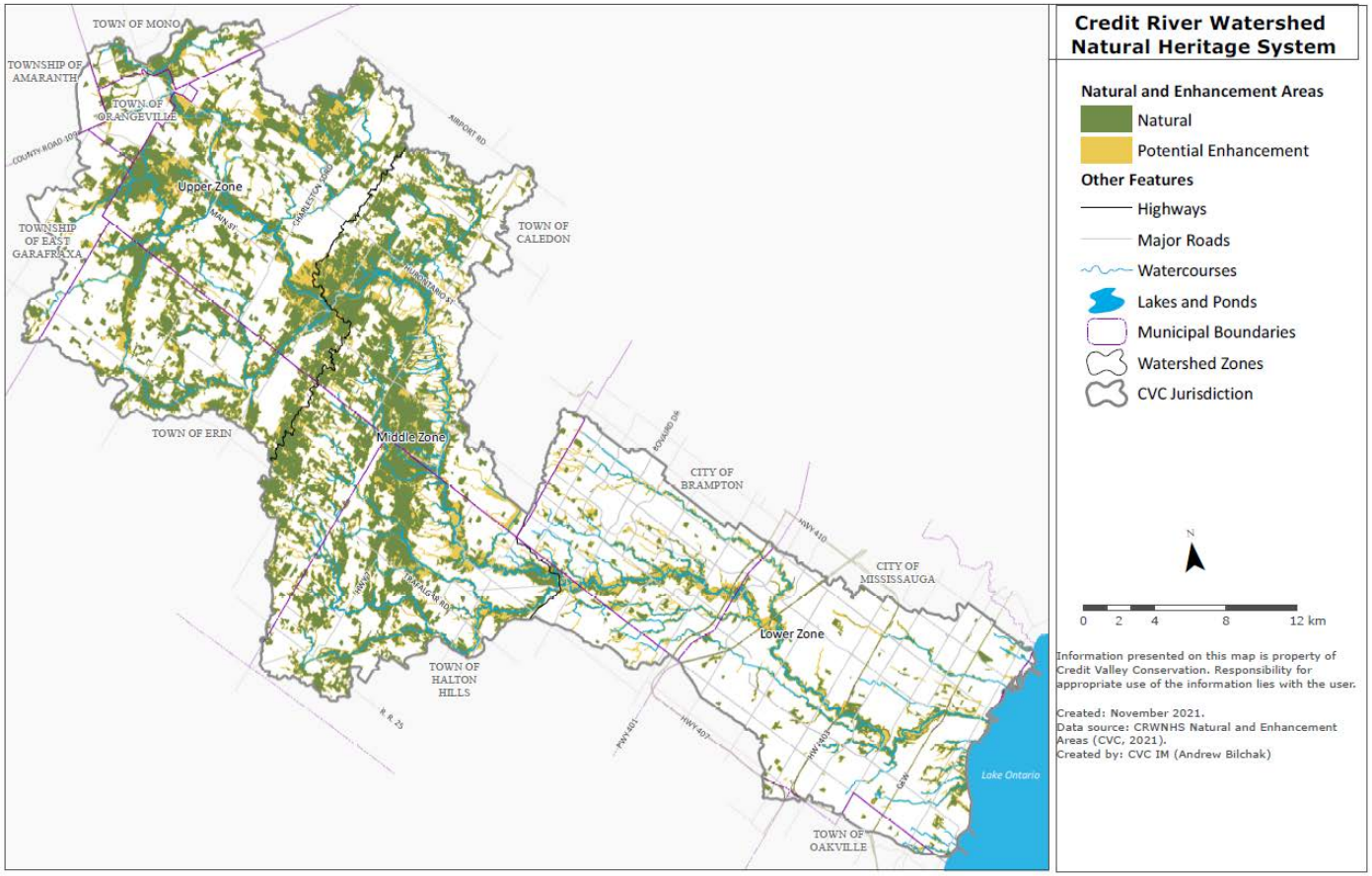
Review & Adapt

Aquatic Ecosystems

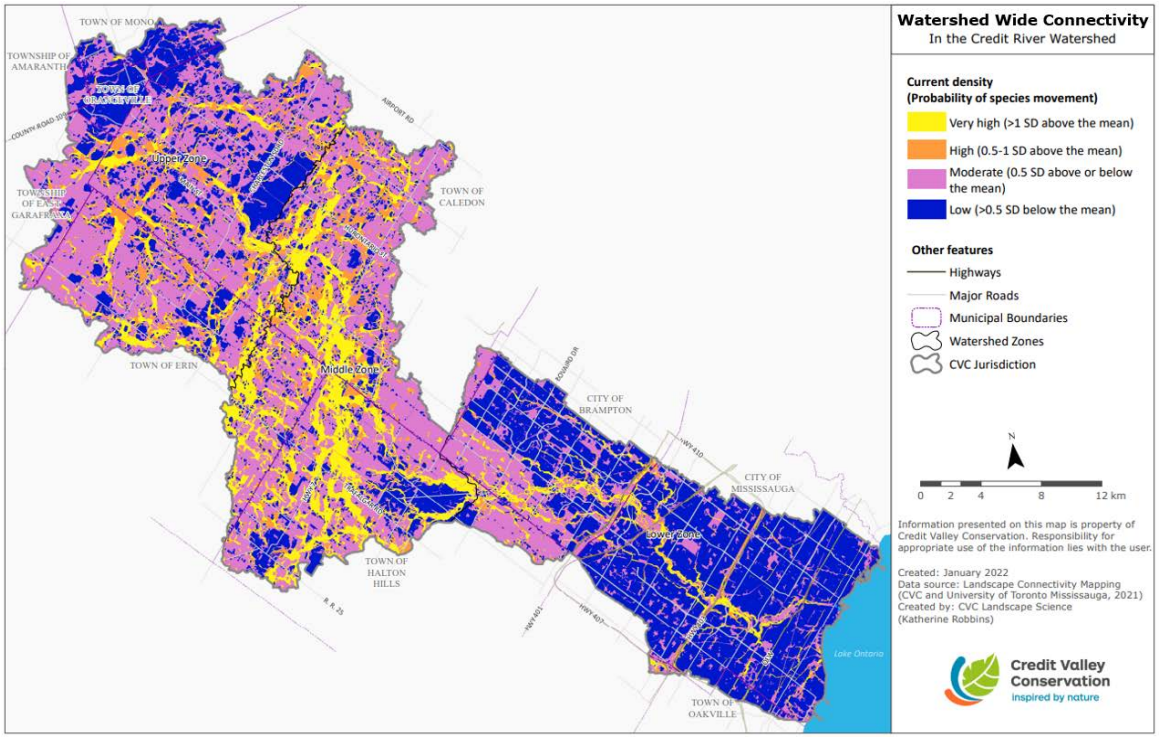
- Mitigate in stream barriers
- Restore instream habitat / natural channels
- Control stream erosion
- Protect ephemeral streams
- Restrict Water taking during drought
- Promote stormwater infiltration
- Reduce nutrient loading
- Manage reservoirs to release cold water
- Plant species with range of tolerances
- Protect stream refugia

Terrestrial Ecosystems

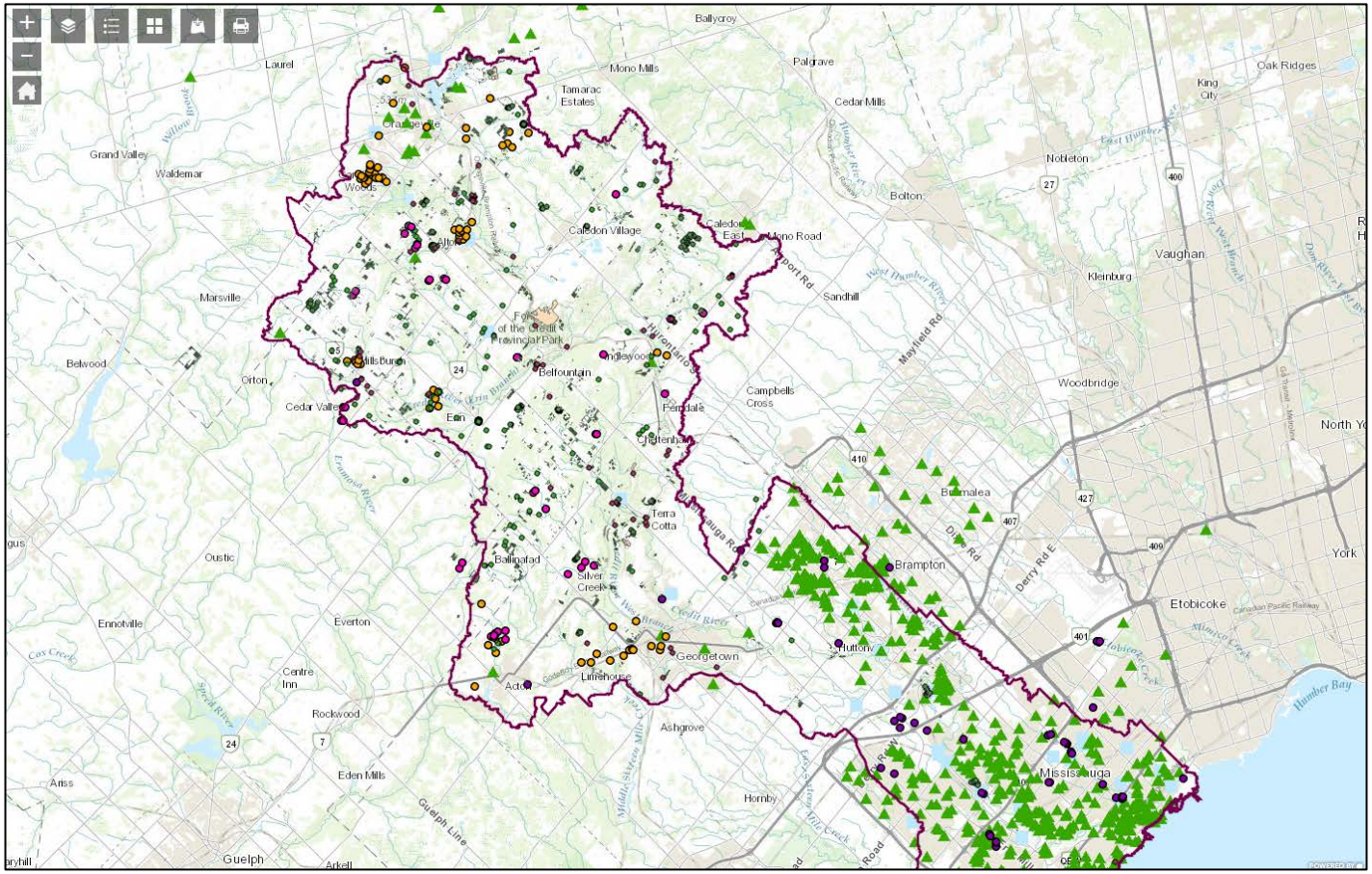
- Manage invasive species
- Increase genetic and structural diversity
- Protect natural systems
- Create / restore natural features
- Increase connectivity
- Reduce disturbance
- Low Impact Development
- Sustainable harvesting
- Buffer protected areas
- Responsible management of seed sources / stock
- Translocation or assisted migration
- Plant species with broader climate tolerance
- Identify and maintain refugia
- Identify habitat for displaced species



Sustain and Protect:
Use existing frameworks to identify and protect a resilient NHS



Grow Resilience: Enhance and restore Watershed-wide Connectivity



Grow Resilience: Restore the landscape

2010

2019

West Credit River riparian planting, Hillsburgh

12,110 Trees and shrubs planted and 6.5 ha restored

2016

2020

Private Landowner, Erin
Grassland Restoration
37 ha grassland created since 2014

East Credit Daylighting, Caledon

800 m stream restored; 0.3 ha wetland restored; 7400 m3 flood storage created; 2 barriers to fish passage removed; 2500 plantings; 1.8 ha riparian grassland created

Pre-restoration

2011

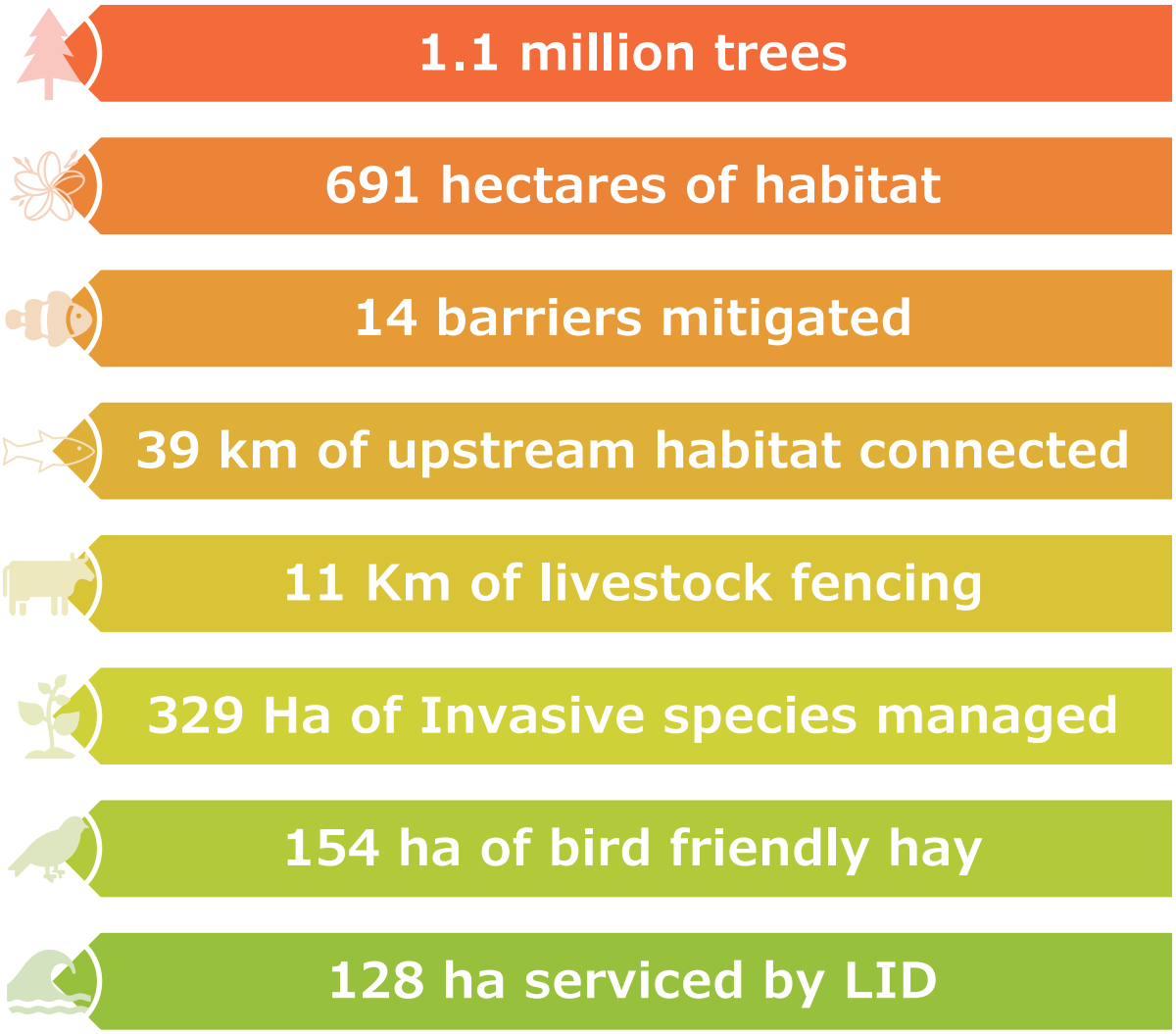
Mid-restoration

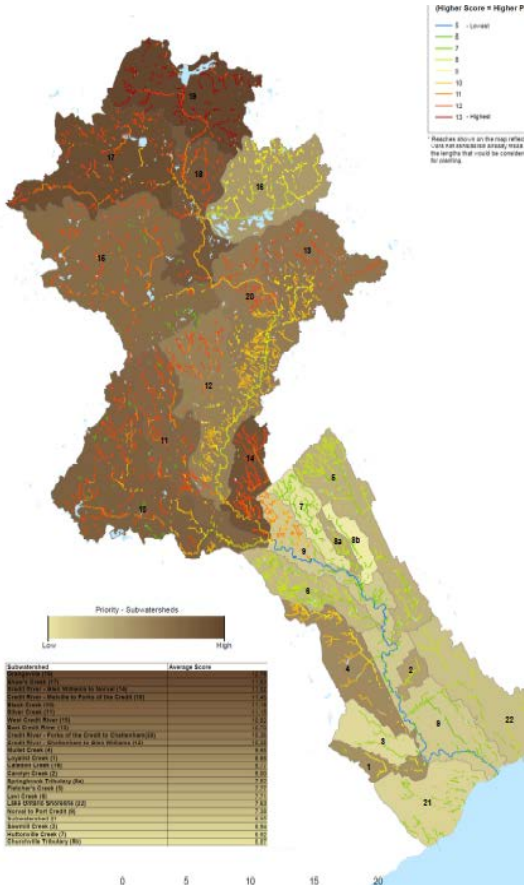
2017

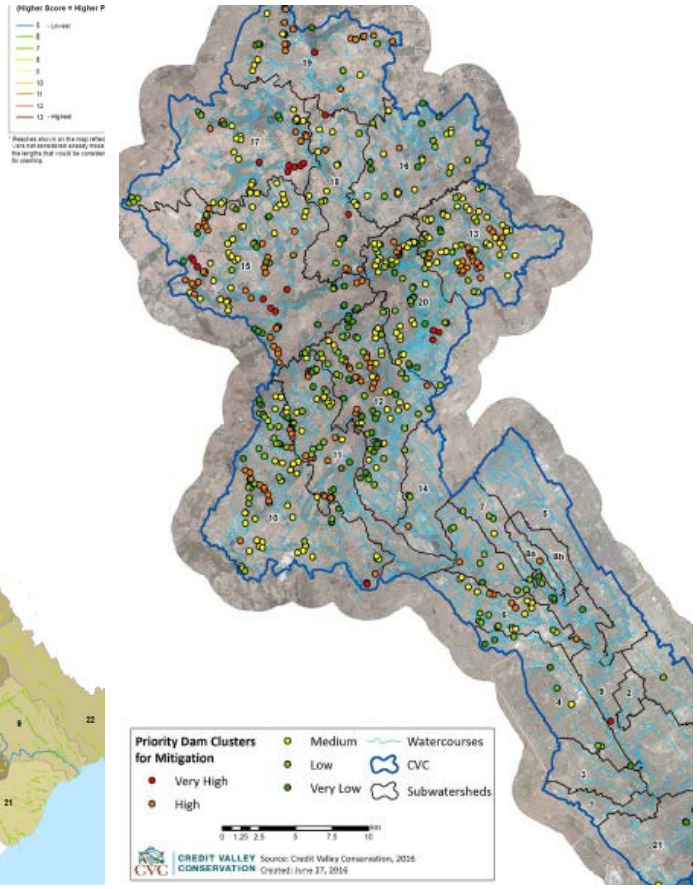
Post-restoration

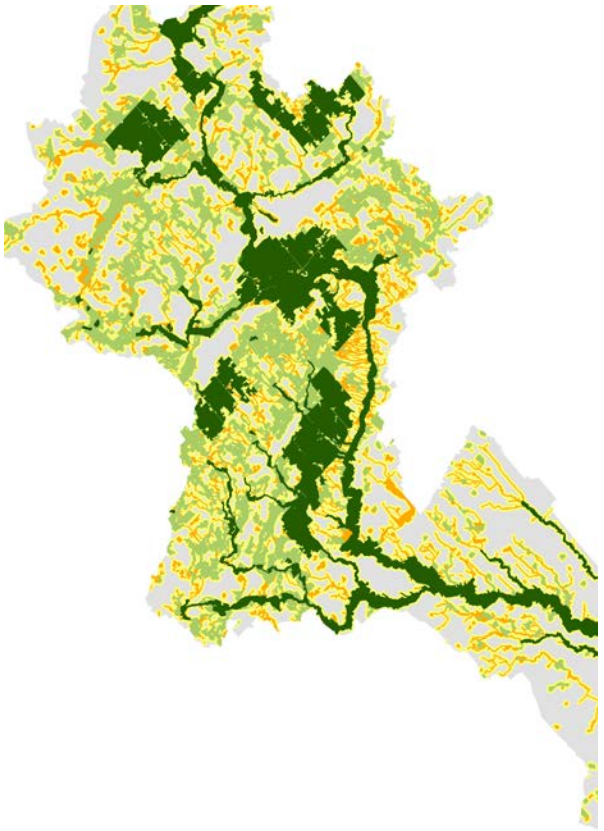
2018

Completed Conservation Actions 2007 - 2020



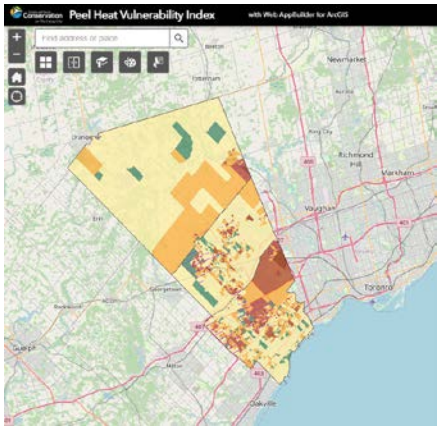


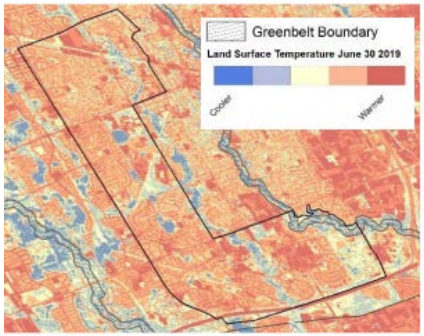




Grow Resilience:
Strategic Restoration Maximizes Climate Adaptation

Grow Resilience:
Co-benefits with reducing human vulnerability

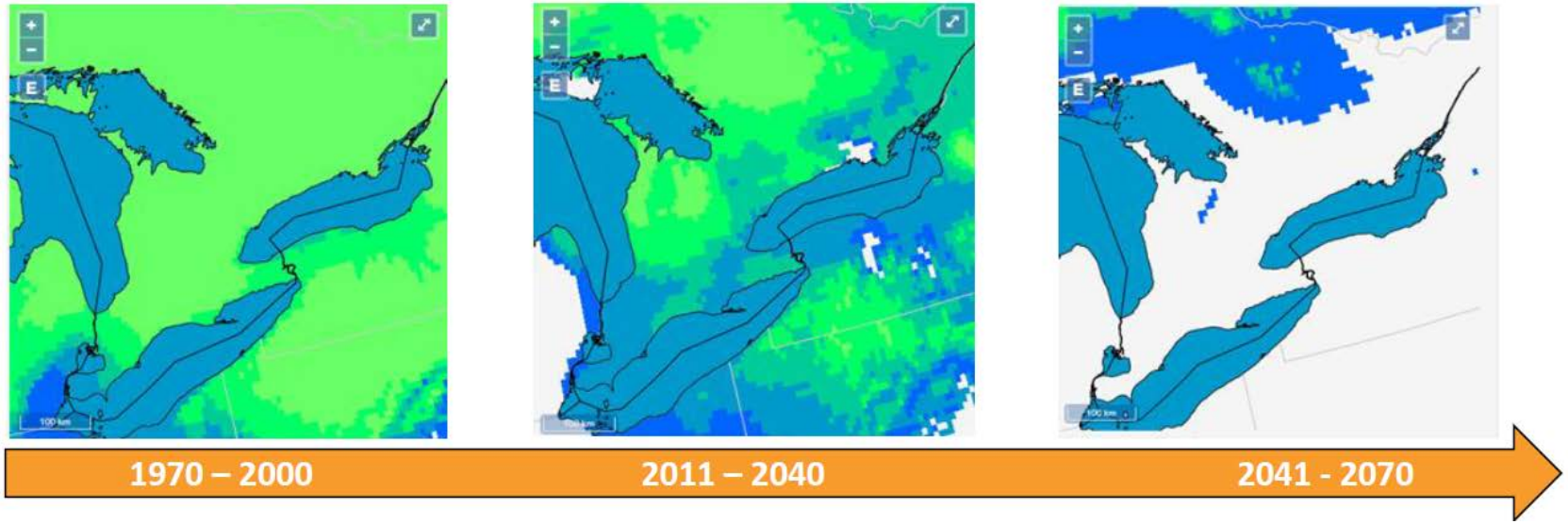




Peel Climate Change Partnership Green Natural Infrastructure Strategy and CVC Community Tree Project tackle reducing urban heat island

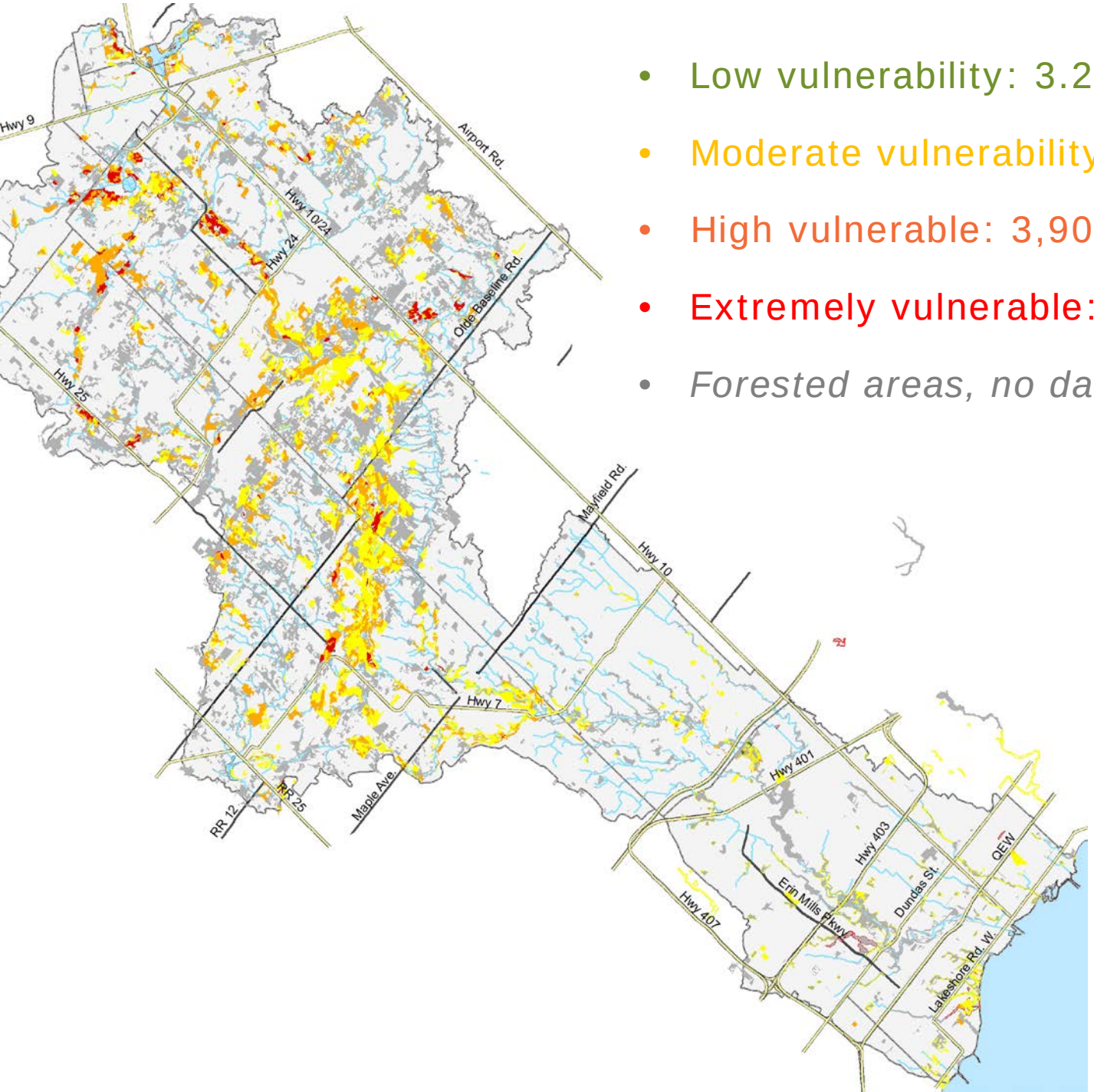
Review and Adapt:
Climate Change Vulnerability Index for Trees

Climate Suitability Range Mapping for White Birch (*Betula papyrifera*), southern Ontario

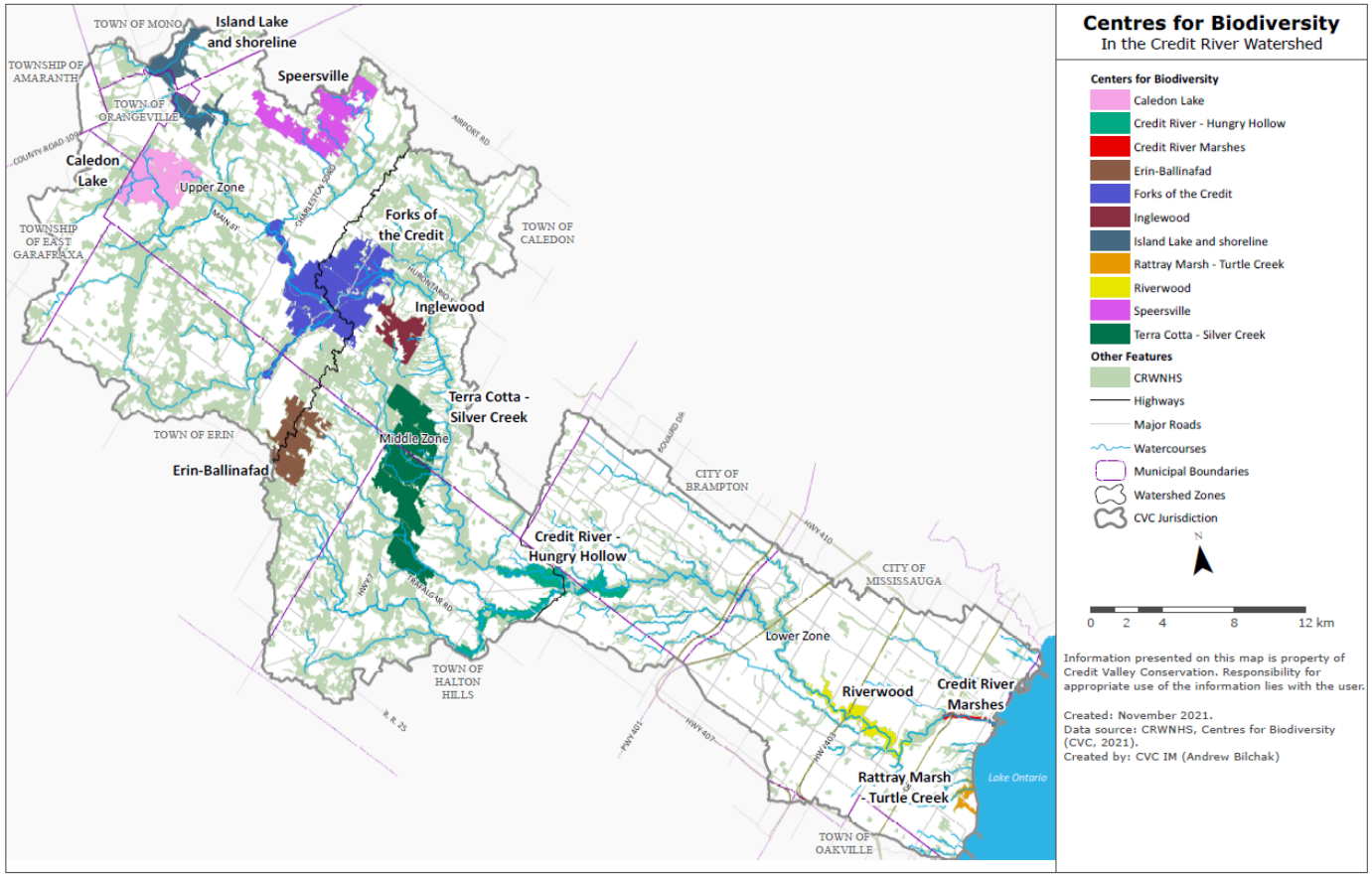


NatureServe

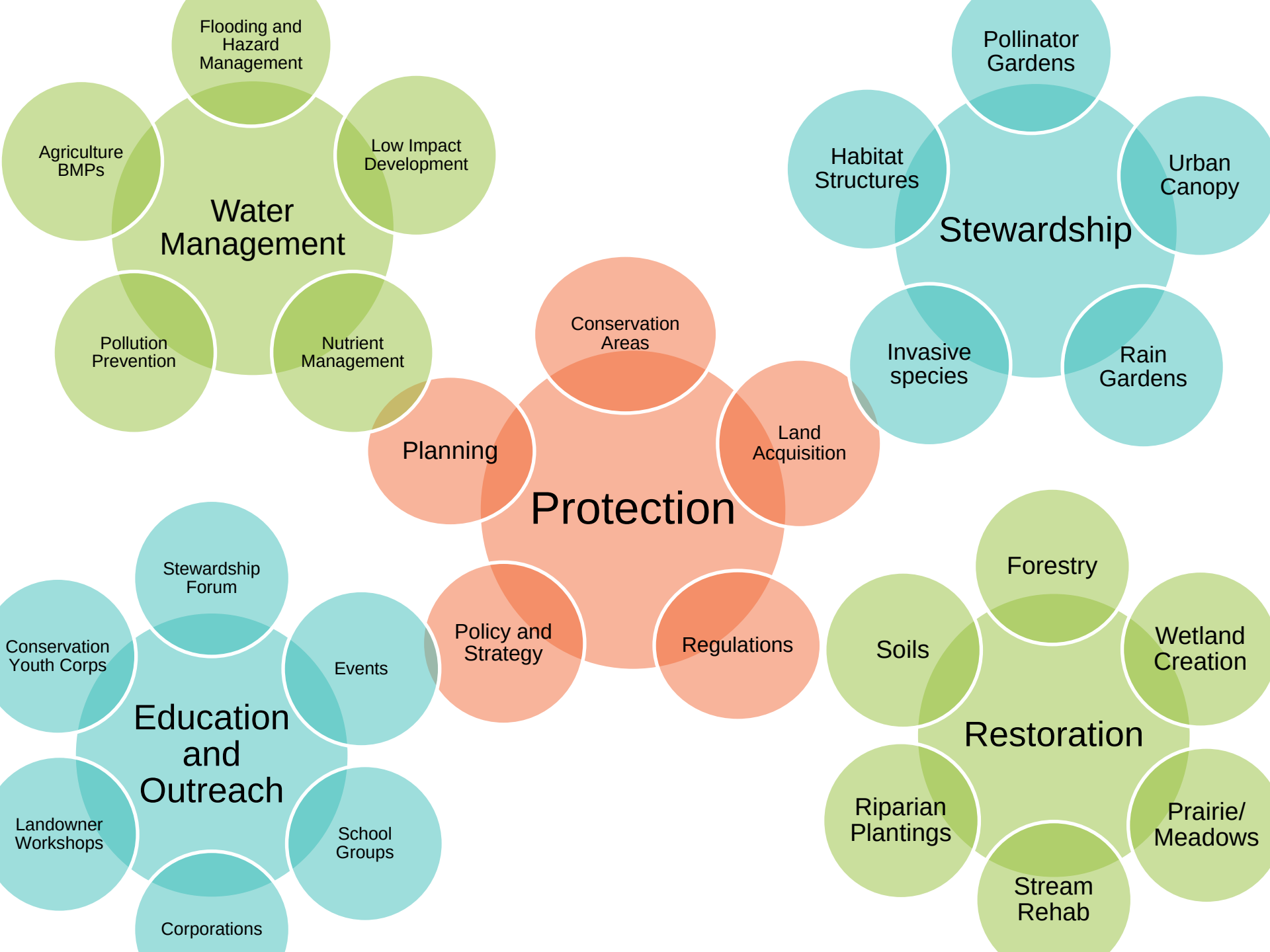
Less Vulnerable	Moderately Vulnerable	Highly Vulnerable	Extremely Vulnerable
Common Buckthorn Glossy Buckthorn Freeman's Maple **6 %** **RCP 4.5**	Ironwood Gray Birch Sugar Maple Blue Beech American Basswood Northern Red Oak Eastern Red Cedar Trembling Aspen Black Cherry Red Maple Balsam Poplar Bigtooth Aspen Rock Elm Manitoba Maple Sassafras Green Ash American Sycamore **31 %**	Black Maple Mountain Maple Silver Maple American Beech Slippery Elm Norway Maple White Pine Bitternut Hickory Black Walnut Bur Oak Paper Birch Pignut Hickory Eastern Cottonwood Yellow Birch Peachleaf Willow Shagbark Hickory White Ash White Oak American Elm Tulip Tree American Chestnut Red Pine Eastern Hemlock Eastern White Cedar Chinquapin Oak **45 %**	Black Willow Red Mulberry Black Oak Black Ash White Spruce Swamp White Oak Balsam Fir Butternut Black Spruce Larch **18 %**



- Low vulnerability: 3.2 ha (<0.1%)
- Moderate vulnerability: 5,812 ha (56.5%)
- High vulnerable: 3,909 ha (38.0%)
- Extremely vulnerable: 569 ha (5.5%)
- *Forested areas, no data*



Review and Adapt:
Early thoughts on climate refugia from an NHS planning perspective


Flooding and Hazard Management
Agriculture BMPs
Low Impact Development
Water Management
Pollution Prevention
Nutrient Management
Pollinator Gardens
Habitat Structures
Urban Canopy
Stewardship
Invasive species
Rain Gardens
Conservation Areas
Planning
Land Acquisition
Protection
Policy and Strategy
Regulations
Stewardship Forum
Conservation Youth Corps
Events
Education and Outreach
Landowner Workshops
School Groups
Corporations
Forestry
Soils
Wetland Creation
Restoration
Riparian Plantings
Prairie/ Meadows
Stream Rehab

Closing Thoughts

- Global climate projections and trends are being seen locally
- We are already seeing impacts to our natural heritage system
- Adaptation relies on employing and strengthening **existing practices** and adapting where needed
- There is increased urgency to act and invest
- This shared responsibility will require collective effort

"...we have to act, we need a whole of society approach, no one can be left out, no household, no businesses, no government..."

Debra Roberts, Co-chair of the IPCC Working Group II report

Reach out to us!

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questions?

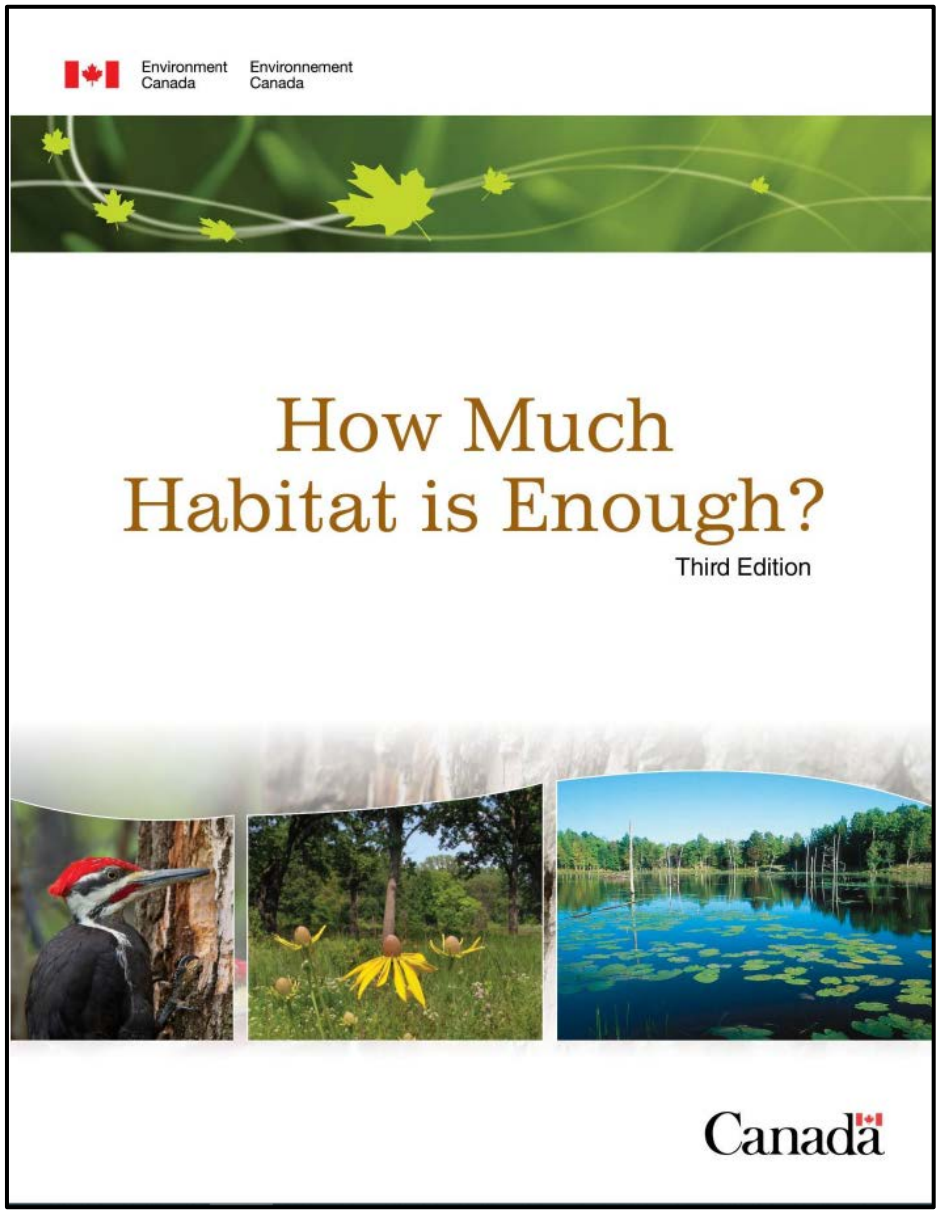
inspired by nature

Notes

- Hard to predict exactly how CC will impact ecosystem composition, structure and function
  - Species relationships with each other and their environments is complicated- we can make some educated guesses, but we will have to wait and see
- The best that we can do is to build resilience into natural heritage
- By enhancing biodiversity we’re investing in an insurance policy that mitigates and adapts to the impacts of climate change

Notes

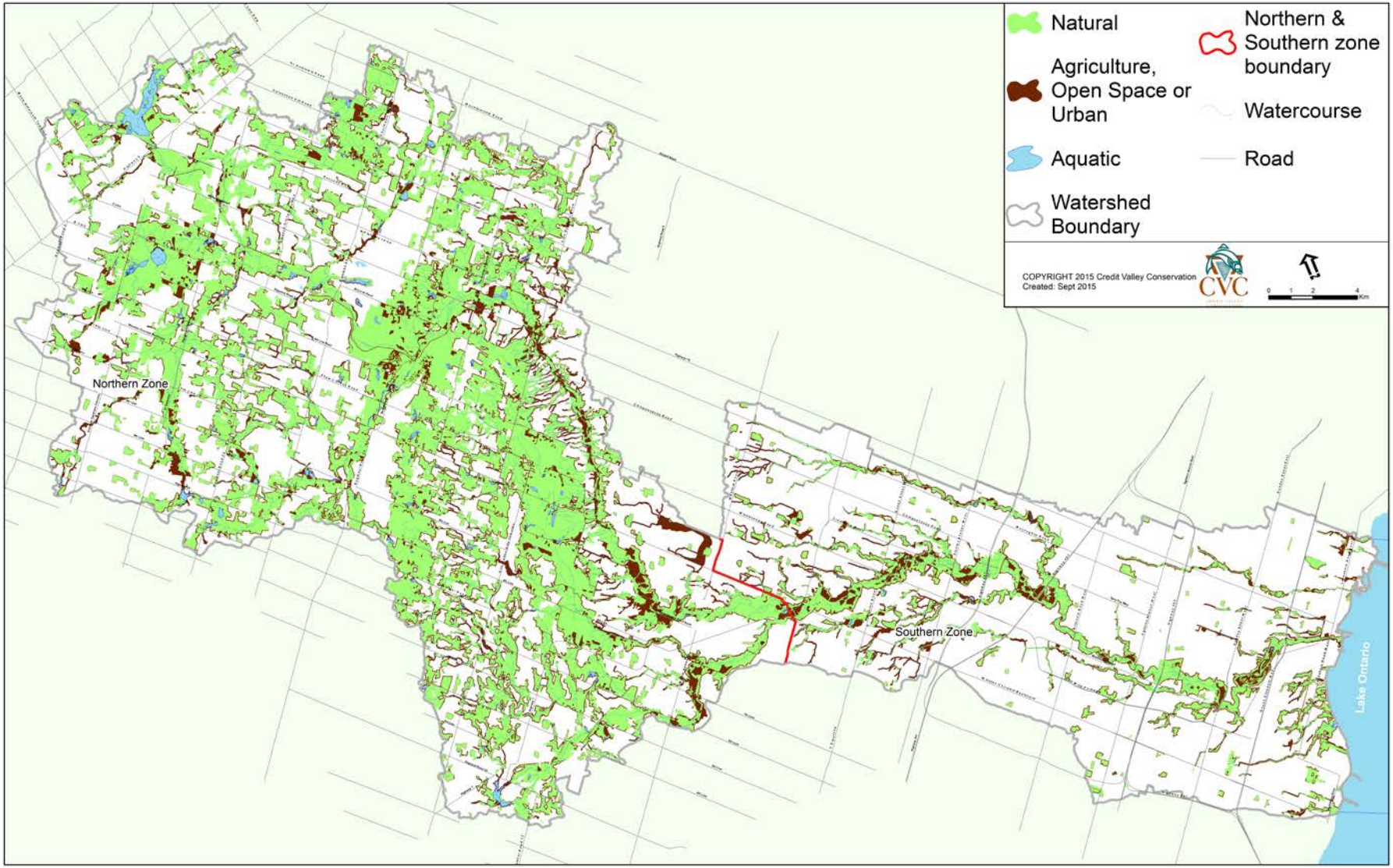
- We do this by protecting and restoring our natural heritage system
- By increasing connectivity to allow species to move between patches that may become less habitable
- By using assisted migration
- By identifying most vulnerable areas and aggressively xx
- By supporting an early warning system that allows us to detect new pests to the watershed, and respond rapidly and decisively



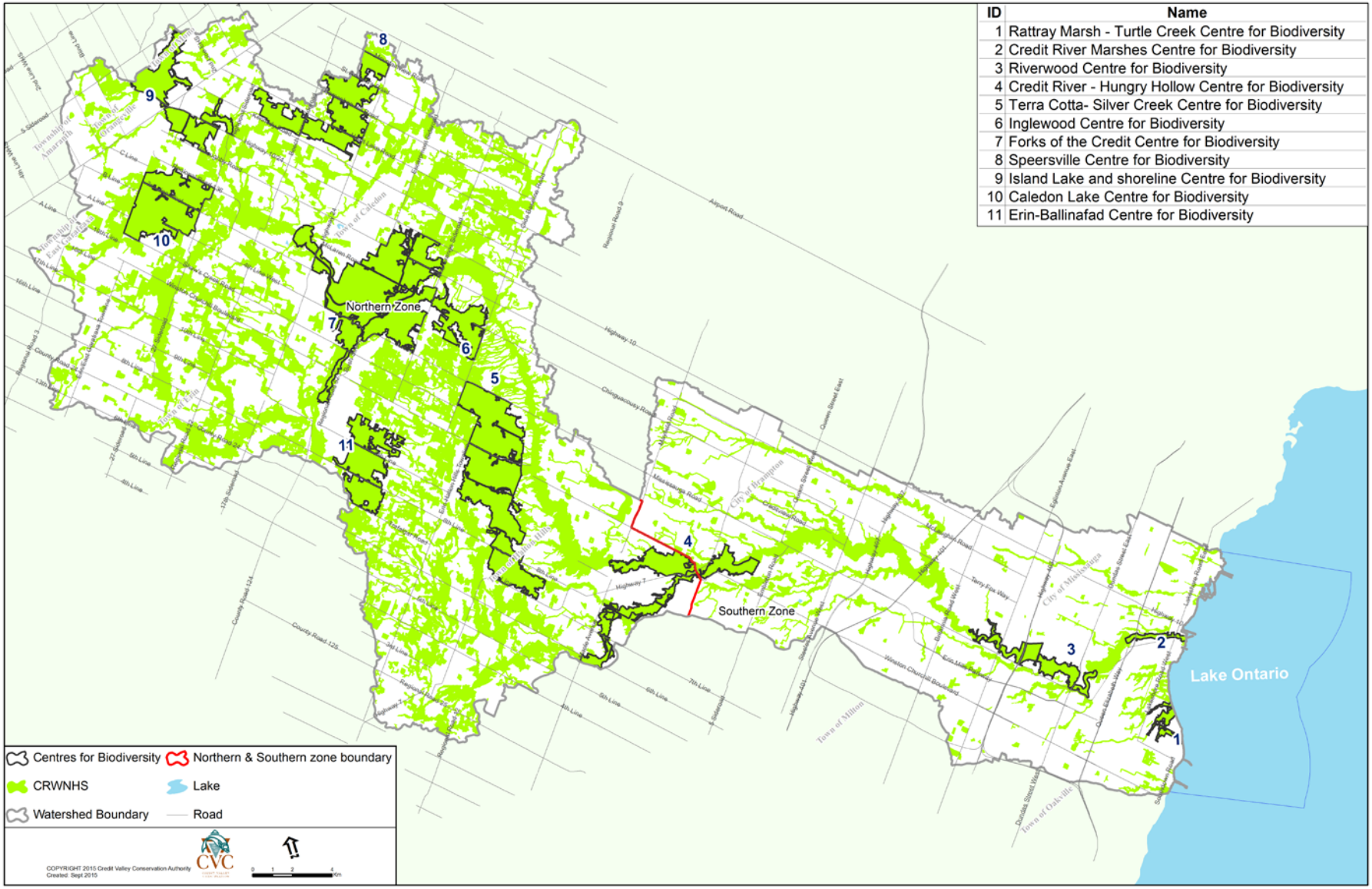
Targets guided by Environment Canada Recommendations and Local Watershed Conditions

NHS Targets

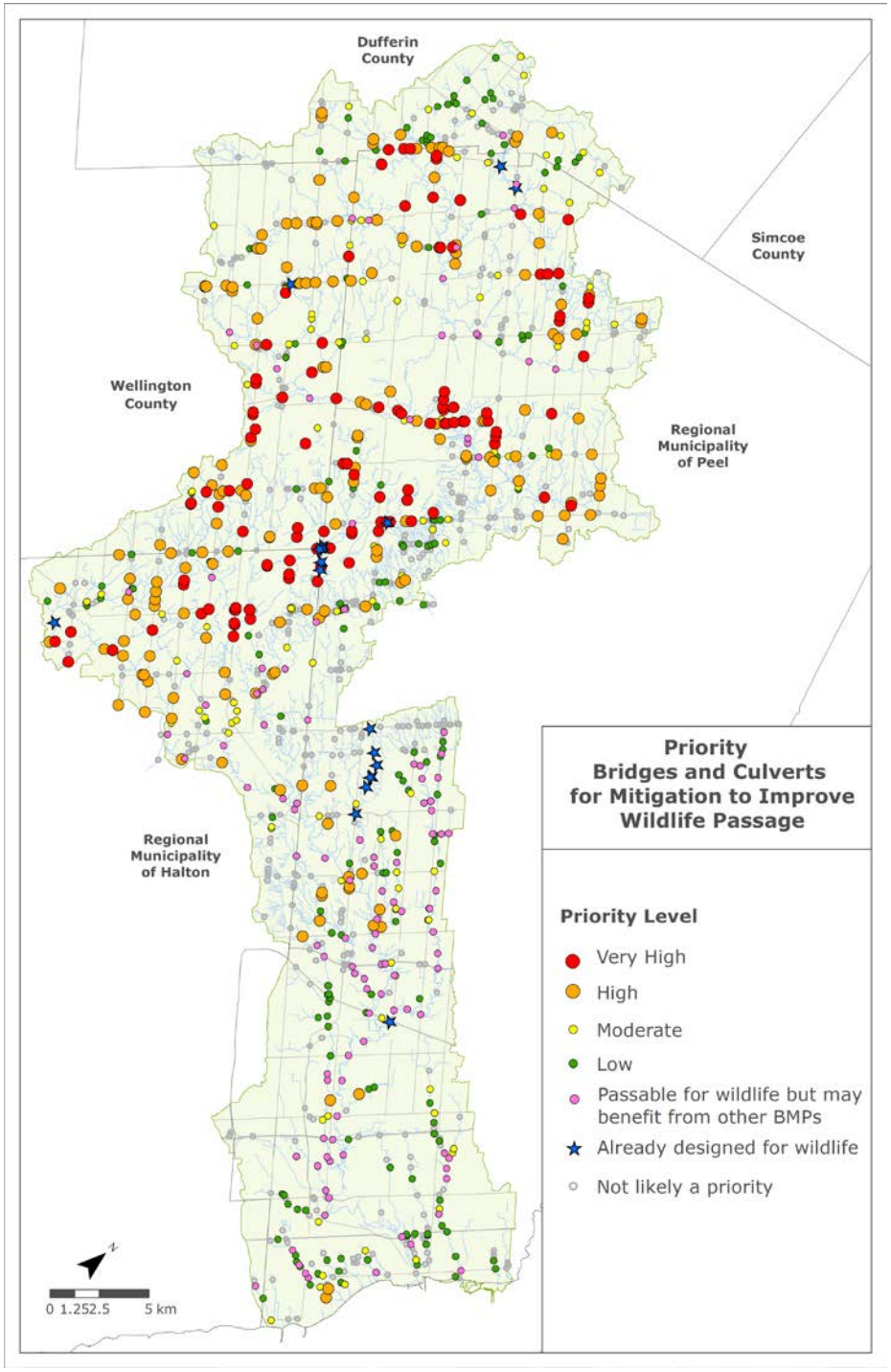
Indicator	Target
Woodland cover	Minimum 30%; Preferred 40%
Woodland interior	10% or greater
Large forest patches	≥1 over 200ha
Wetland cover	10.4%
Riparian cover	90% natural cover within 30m of streams
Valleyland cover	90% natural cover
Ecological Communities: Floral and faunal	Maintain the number of **floral and faunal communities** documented through inventory and monitoring
Biodiversity	Maintain **functional guilds** and species as documented through monitoring and inventory



Credit River Watershed
Natural Heritage System



Credit River Watershed NHS and Centers for Biodiversity



Phase 2 Results: Wildlife Passage Priorities

Priorities based on:

- Landscape connectivity
- Patch network connectivity
- Centres for Biodiversity and natural heritage features in the Natural Heritage System
- Wetland connections

Closing Thoughts

Protecting biodiversity requires strategy, monitoring, policy and on the ground action

Analysis of local data should guide our strategies

Partnerships with Municipalities, local non-profits, landowners, the public and Universities are critical

Collective responsibility to maintain our natural environment

Grow Resilience: Mitigate Stressors

Grow Resilience:
Remove barriers at strategic locations

Sustain & Protect

Grow

Review & Adapt

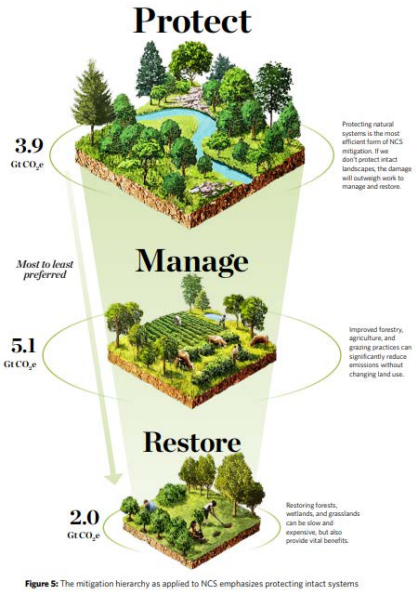
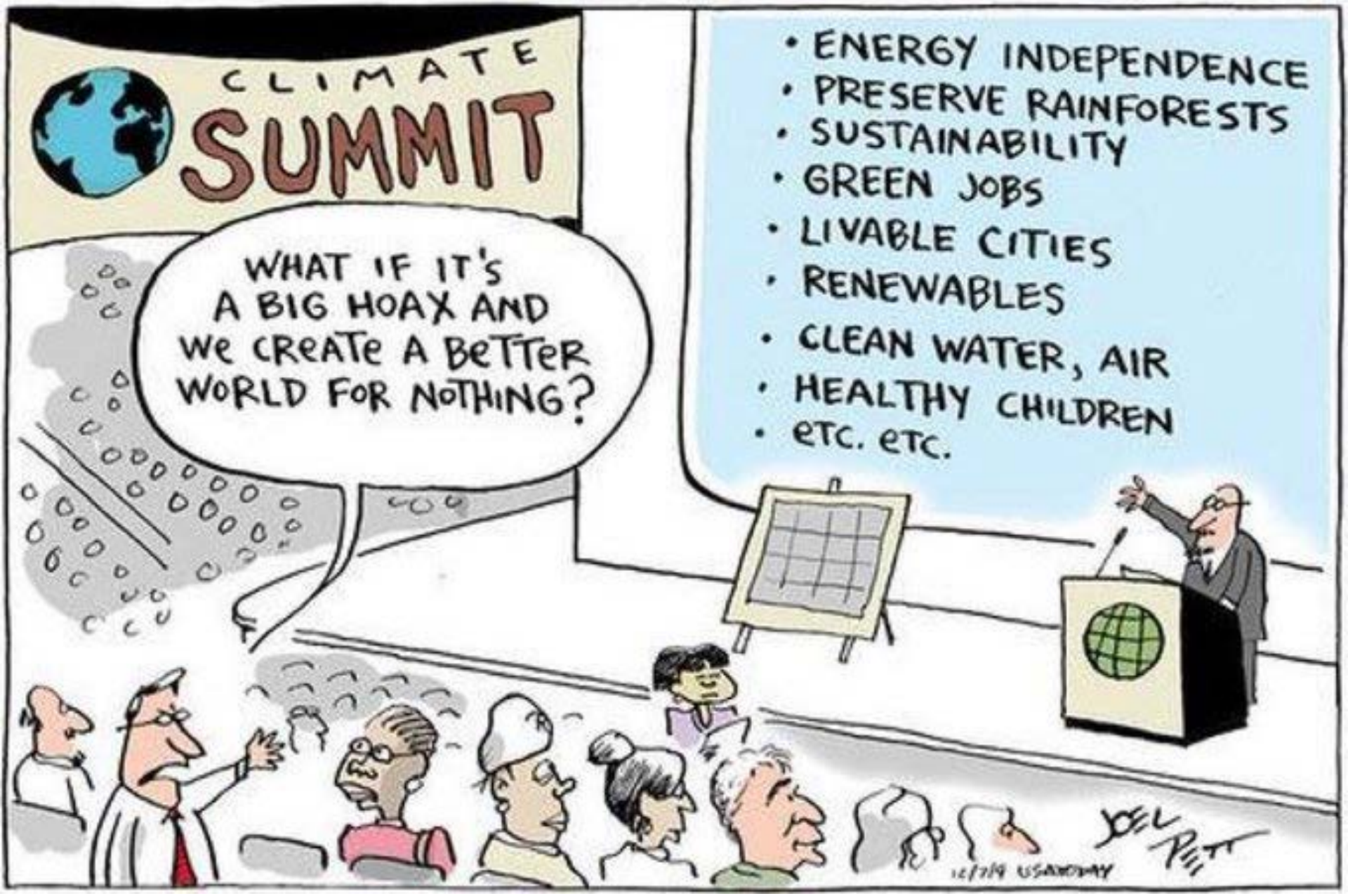


Figure 5: The mitigation hierarchy as applied to NCS emphasizes protecting intact systems


CLIMATE
SUMMIT
WHAT IF IT'S A BIG HOAX AND WE CREATE A BETTER WORLD FOR NOTHING?
• ENERGY INDEPENDENCE
• PRESERVE RAINFORESTS
• SUSTAINABILITY
• GREEN JOBS
• LIVABLE CITIES
• RENEWABLES
• CLEAN WATER, AIR
• HEALTHY CHILDREN
• ETC. ETC.
JOEL PETT