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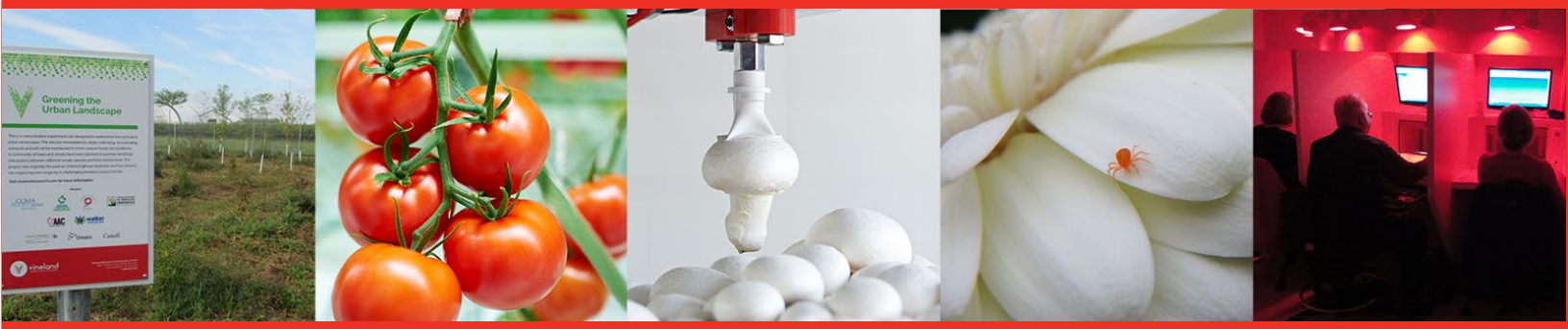
Adapting to Change

Climate-Smart Strategies for the Bruce Trail Conservancy



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Adapting to Change: Climate-Smart Strategies for the Bruce Trail Conservancy – Activity One

Climate change is already reshaping Ontario's forests by altering growing conditions, shifting species ranges, and increasing pressure on ecosystems that have evolved over thousands of years. For conservation organizations responsible for long-term land stewardship, understanding these changes is essential to making informed decisions both now and in the future.

To support this work, Vineland Research and Innovation Centre is leading *Adapting to Change: Climate-Smart Strategies for Ecological Restoration and Habitat Connectivity in BTC Lands* on behalf of the Bruce Trail Conservancy (BTC). This project applies climate science, ecological data, and landscape-scale analysis to help BTC anticipate how its protected lands along the Niagara Escarpment may change under future climate conditions and how conservation actions can adapt in response.

Project Purpose and Scope

The Niagara Escarpment is one of Canada's most ecologically and geologically significant natural corridors, supporting a wide range of forest types, rare habitats, and species at risk. BTC protects and stewards lands across the Escarpment, spanning southern and central Ontario. This conservation corridor extends more than 900 kilometres and plays a vital role in biodiversity conservation, habitat connectivity, and ecosystem services.

The goal of Adapting to Change is to strengthen BTC's ability to plan for the future by integrating climate projections into ecological restoration, land management, and connectivity planning. Rather than reacting to change after it occurs, the project focuses on anticipating where and how ecosystems are likely to shift and identifying proactive strategies that support long-term resilience.

Assessing Climate Suitability Across BTC Lands

The first phase of the project focused on understanding how existing forest types and native plant communities on BTC-managed lands may respond to future climate conditions.

Vineland assessed 27 BTC properties distributed across the Trail, covering both the Lake Erie–Lake Ontario and Lake Simcoe–Rideau ecoregions. These properties span a wide range of elevations, landforms, and ecological conditions, making them well suited to understanding how climate impacts may vary across the Escarpment.

Using Ecological Land Classification data and BTC stewardship information, Vineland identified dominant forest types and canopy species on each property. Canopy trees such as sugar maple, white cedar, red oak, hemlock, trembling aspen, and white ash were used as ecological indicators because they are long-lived, structurally dominant, and closely tied to climate conditions.

Integrating Climate Projections

To evaluate future climate suitability, Vineland applied downscaled climate projections extending to the year 2100 using a moderate emissions scenario. Four key climate variables were analyzed for each property:

- Mean annual temperature
- Mean annual precipitation
- Growing degree days
- Frost-free days

These variables directly influence tree growth, survival, and regeneration, and together provide a strong basis for assessing long-term forest viability.

Changes in each variable were calculated relative to historical baseline conditions, normalized to allow comparison across metrics, and combined into a Climate Change Index. This index allowed properties to be ranked based on the magnitude of projected climatic change they are expected to experience by the end of the century.

What the Analysis Revealed

The assessment showed that climate exposure across BTC lands is not uniform.

Some of the most significant projected changes are expected in northern and higher elevation properties, particularly in the Sydenham, Beaver Valley, and Peninsula sections of the Trail. Although these sites historically experienced cooler conditions, climate projections indicate substantial warming, longer growing seasons, and notable departures from past climate norms. These changes may place stress on forests dominated by cool-adapted or moisture-dependent species.

In contrast, southern properties, especially in the Niagara and Iroquoia sections, are projected to experience more moderate climatic shifts. Many of these sites are dominated by species that are relatively tolerant of warmer temperatures and longer growing seasons, suggesting they may function as climate refuges under future conditions.

Importantly, the results show that vulnerability is shaped by a combination of factors, including species composition, site conditions, and the rate of climate change, not simply latitude or elevation alone.

Implications for Forests and Biodiversity

As climate conditions shift, some forest communities are likely to undergo gradual transitions in species composition and structure. In higher-risk areas, forests dominated by sugar maple, birch, aspen, or hemlock may experience increased stress, reduced regeneration success, or greater vulnerability to pests and disease. Over time, these changes could lead to different forest assemblages, potentially favouring species that are more tolerant of heat and moisture variability.

At the same time, the Niagara Escarpment’s complex topography, including ravines, talus slopes, wetlands, and cold-air pockets, offers opportunities for microclimatic buffering.

Protecting and enhancing this habitat diversity will be critical for maintaining biodiversity and ecological function as the climate continues to change.

Building a Foundation for Climate-Smart Action

This climate suitability assessment provides BTC with a science-based foundation to support future conservation decisions. The findings will help inform:

- Climate-adaptive restoration and species selection
- Prioritization of monitoring and management efforts
- Protection and strengthening of habitat connectivity
- Identification of sites that may serve as climate refuges or require proactive intervention.

Rather than prescribing immediate changes, this work equips BTC with the information needed to plan strategically and respond adaptively as conditions evolve.

Looking Ahead

The climate suitability assessment represents one component of a broader, integrated project. Upcoming work will build on these findings by examining habitat connectivity and corridor gaps, reviewing and refining restoration practices, engaging conservation partners across the region, and sharing results with both technical audiences and the public.

Together, these efforts aim to support the Bruce Trail Conservancy’s long-term mission of protecting biodiversity, strengthening ecological resilience, and stewarding the Niagara Escarpment for generations to come.

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