CLIMATE-DRIVEN VULNERABILITY ASSESSMENT OF HAMILTON'S URBAN FOREST:

A Ward-Level Resilience Framework for 2030, 2050, and 2080

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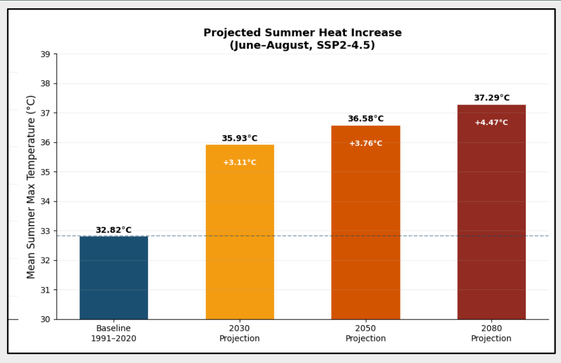
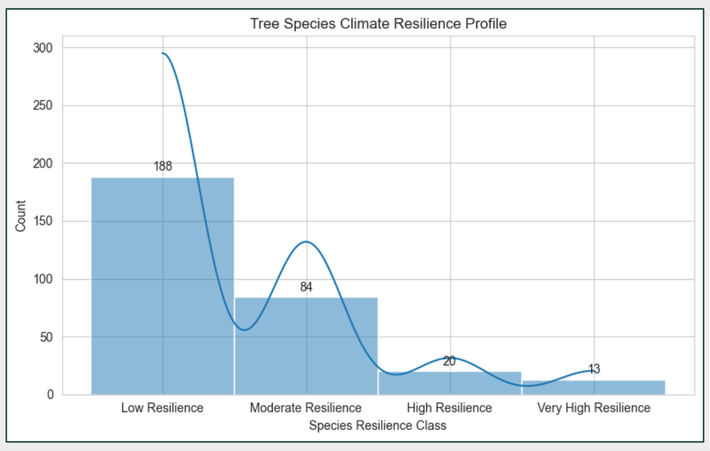
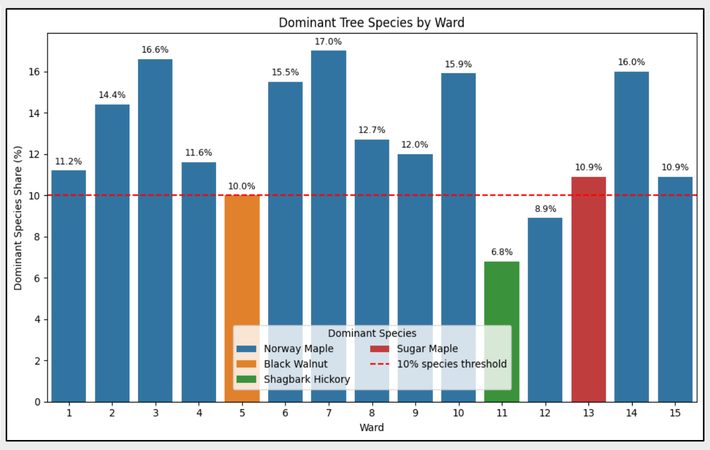
The City Problem

- 275,156 trees inventory, 15 wards analyzed
- Extreme Heat & Flooding identified as Priority Risks
- Norway Maple (Invasive Species) Dominance
- Summer Heat +4.47°C Projected Increase by 2080







RESEARCH QUESTIONS

RQ1: Climate Exposure

How vulnerable is Hamilton's current urban forest to future climate change?

Does current species composition provide sufficient resilience to future climate conditions?

RQ2: Species Resilience

RQ3: Spatial Risk Concentration

Which wards and dominant species exhibit the highest climate vulnerability?

SPECIES VULNERABILITY SCORE (IPCC AR5 FRAMEWORK)

Exposure

Magnitude of climate stress

Extreme Heat Intensity (ΔTXx) x (1 + Heat Index)

ISA Heat Index = Σ (Population_Category × Impervious Surface Weight)

+

Sensitivity (1 - Resilience score)

Susceptibility to climate stress

Resilience = Heat (AHS Temp >30°C), **Hydroclimate** (Drought + Saturated Soil Tolerance), **Pollution Tolerance, Climate Suitability**

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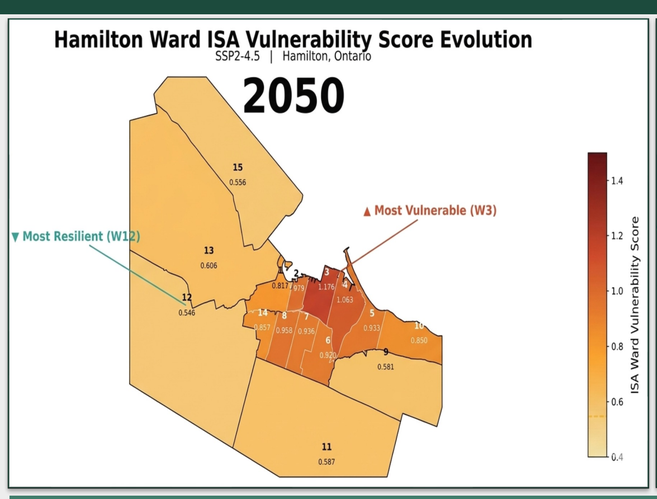
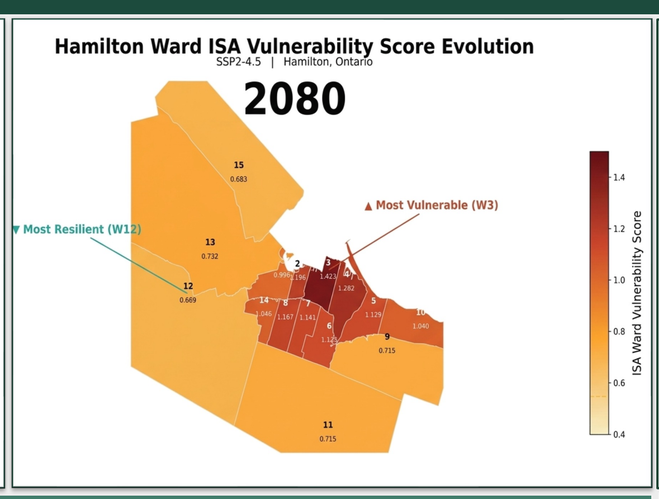
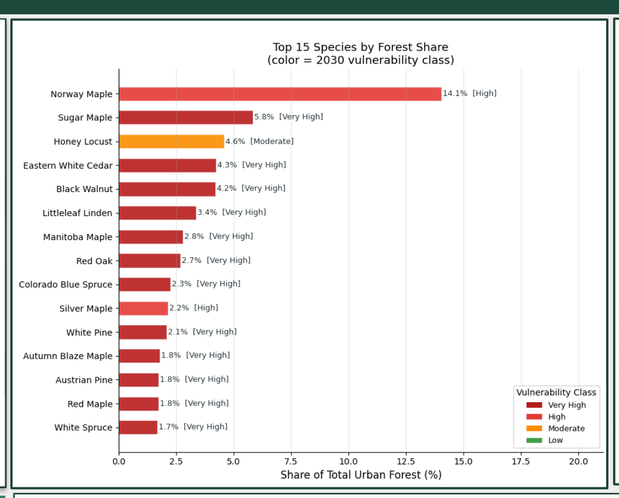
Adaptive Capacity

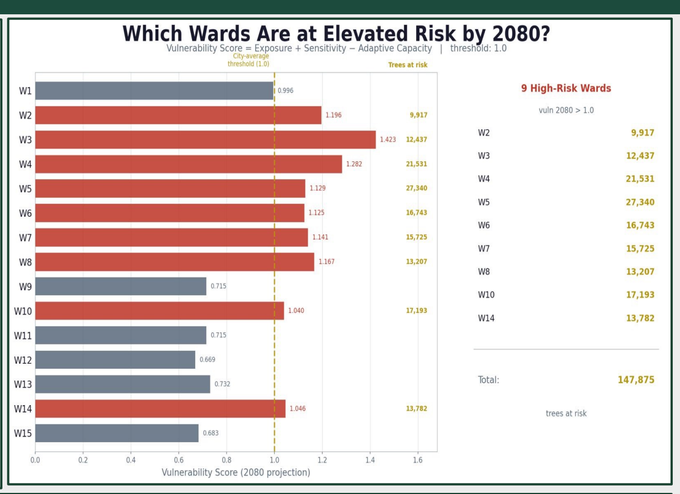
Ecosystem ability to recover

DBH (Diameter at Breast Height)









10/20/30 RULE FOR BIODIVERSITY

No single species >10% | No genus >20% | No family >30%

Hamilton's Violations:

- Norway Maple exceeds 10% species threshold
- Acer genus exceeds 20% in 14 of 15 wards
- Ward 4: 31% Acer dominance
- Sapindaceae family approaching 30% limit

Fraxinus Species (Ash Trees)

9,170 trees (3.3% of inventory)

Highly vulnerable to Emerald Ash Borer

Excluded from recommendations

Extreme pest susceptibility eliminates future planting viability

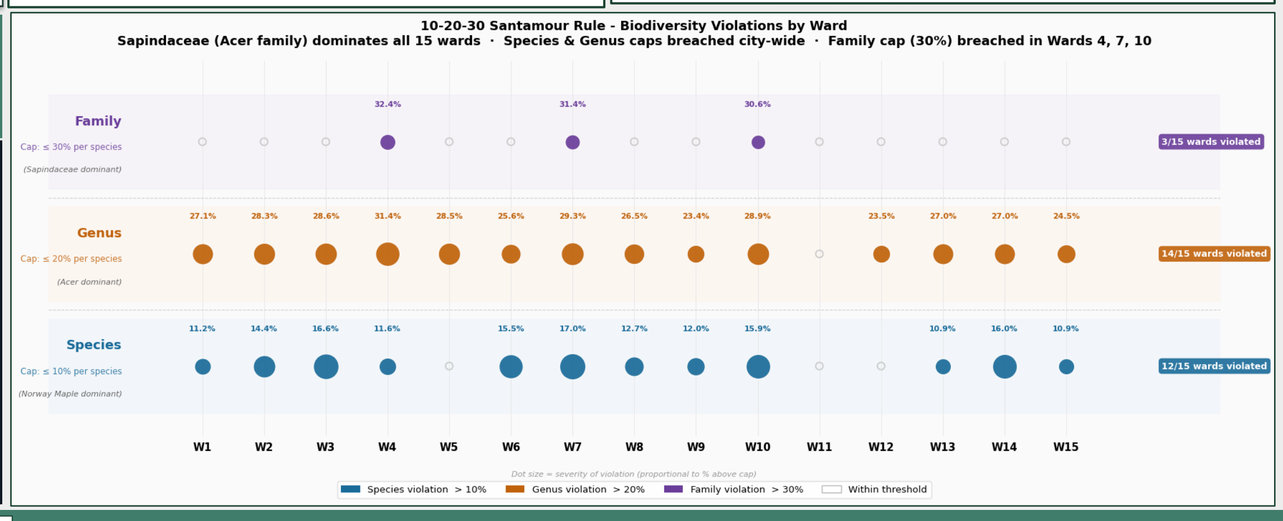
Norway Maple (Acer platanoides)

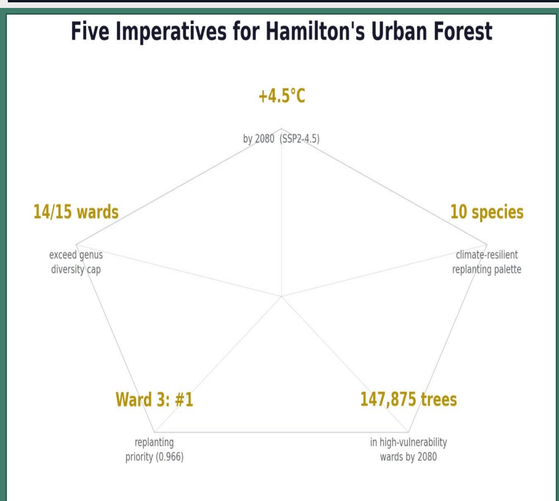
11.9% of total urban forest

Exceeds 10% Santamour threshold

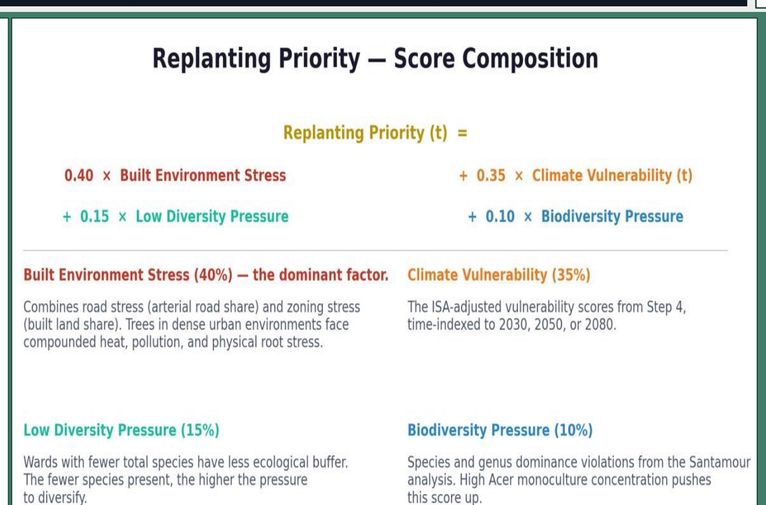
Major vulnerability contributor

Acer genus exceeds 20% threshold in 14 of 15 wards. Dominant urban species contributing significantly to overall forest vulnerability.



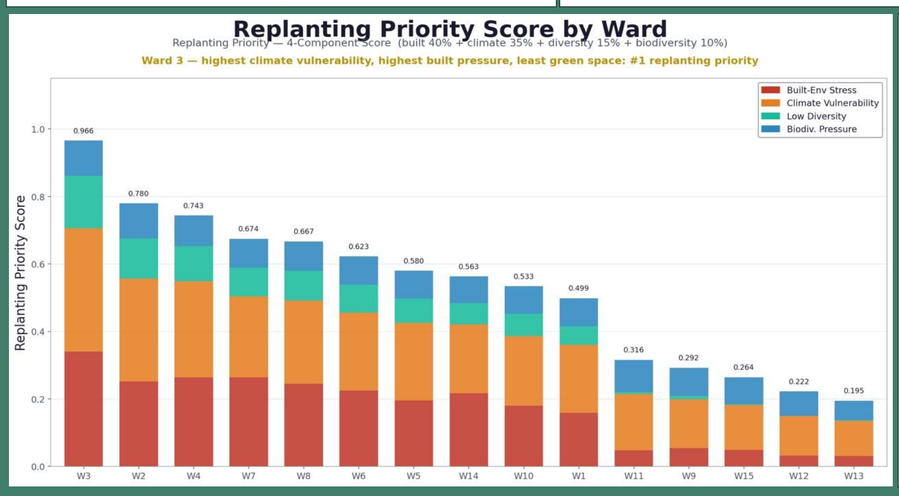


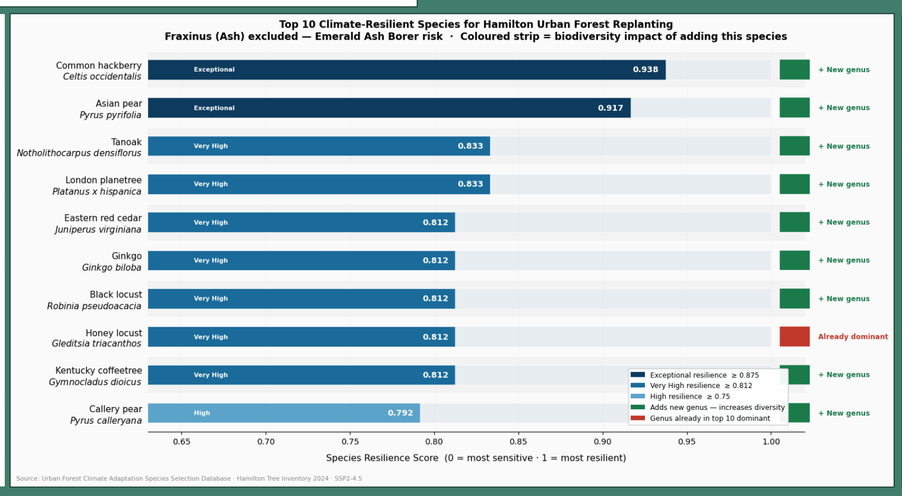
Plant the right trees. In the right wards. Before it's too late.

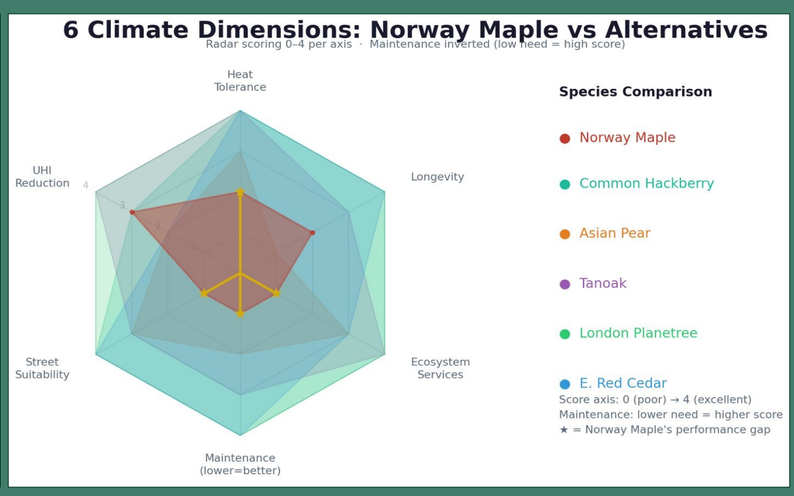


STRATEGIC CLIMATE ADAPTATION PLAN

- Prioritize Replanting Climate-resilient species for Ward 3, 4, 7
- Prioritize Incentives for Private Planting and Streetscape Retrofits in Wards 2 & 7 (where Public & Private canopy Coverage < 20%)
- Diversify Species Portfolio & Enhance Ecosystem Resilience
- Common hackberry (0.938) & Asian pear (0.917) - Highest resilience.
- Integrate Resilience Scoring into City of Hamilton Urban Forest Strategy Implementation







THE BIGGEST RISK to Urban Forest is **NOT Climate Alone**! Strategic Coordinated Action Across **Vulnerable Wards, Species Diversification,** and **Policy Integration** is Required!

Primary Data Sources: • City of Hamilton Open Data Portal • GBIF Backbone Taxonomy • Metro Vancouver: Urban Forest Climate Adaptation Species Selection Database • CanDCS-M6 / Canadian Centre for Climate Services • Ontario Climate Station Records

Key References: IPCC AR5 WGII Chapter 19 (2014)-Emergent risks and key vulnerabilities., Santamour, F.S. (1990). The triangle test for measuring genetic diversity., City of Hamilton Urban Forest Strategy (2020)., Stewart, I.D. & Oke, T.R. (2012). Local climatezones for urban temperature studies.