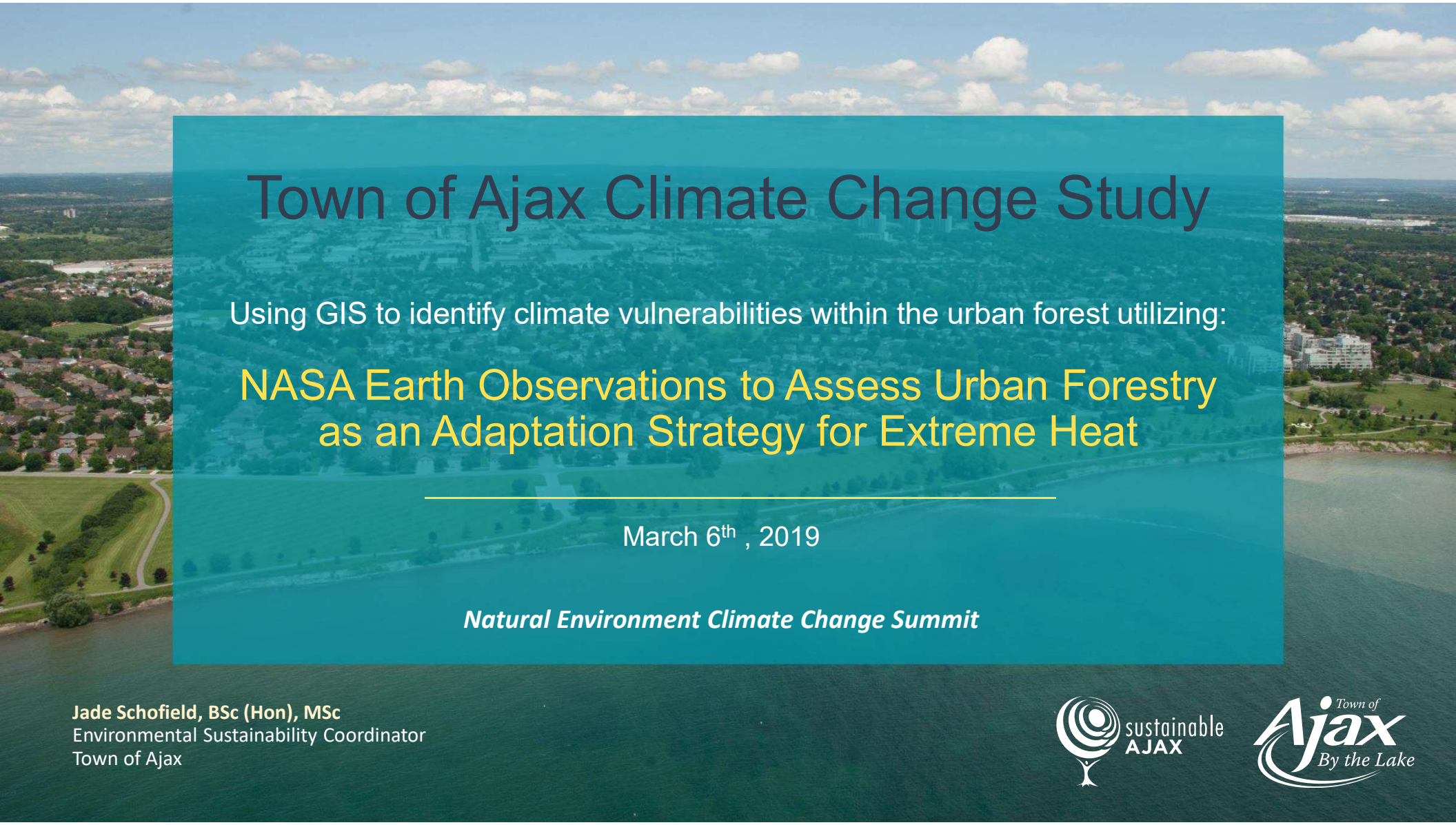


Town of Ajax Climate Change Study

Using GIS to identify climate vulnerabilities within the urban forest utilizing:

NASA Earth Observations to Assess Urban Forestry as an Adaptation Strategy for Extreme Heat

March 6th , 2019

Natural Environment Climate Change Summit

Jade Schofield, BSc (Hon), MSc
Environmental Sustainability Coordinator
Town of Ajax

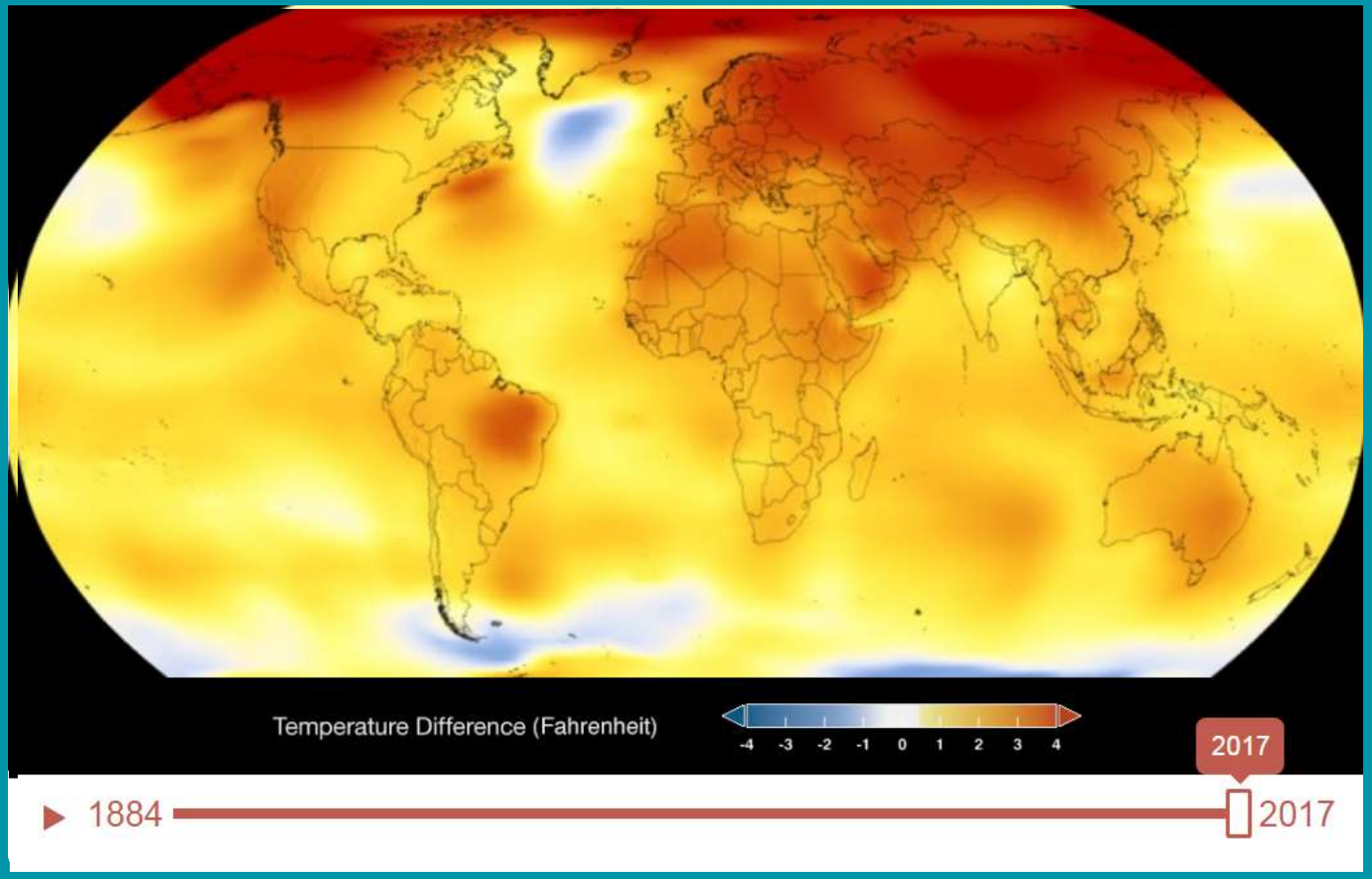
sustainable AJAX

Town of Ajax By the Lake

Town of Ajax By the Lake

- Local municipality within the Region of Durham
- Population 118,000 (2016)
- 67 km^2
- Primarily suburban with rapid population growth
- Greenbelt to the North and East
- Largest uninterrupted greenspace along shoreline of Lake Ontario in GTA
- TRCA (Duffins & Carruthers) & CLOCA (Lynde) watersheds

NASA- Climate Time Machine



Climate Modelling for Ajax

Climate Change

WARMER

Heat

>30°C: **3** days/yr to **16.8** days/yr,

>35°C **0** days/yr to **4** days/yr

4°C avg; higher in winter

Heat waves

30°C more than 2 days **0.025** events/yr to **3.9** events/yr

Humidity

>**40°**C eq **0.025** events/yr to **3.9** events/yr

>**45°**C eq. 0 to 3.2 events/yr

Peak humidex in 2040s: **48°C** eq.

WETTER

Approx. **16 %** increase in snow & rain

Increased significant rainfall events (>50mm in 6 hours)

1.5 to **5.3** events/yr

Reduction in the number of days with snow more than 5 cm - 75%

- January more rain - 138% and less snow - 67%
- February more rain - 233% and less snow - 77%

WILDER

Increase in violent storms by **7%**

Projected increase of days with high potential for lightning **59%**

Increased wind storms including tornados (risk of Tornados could increase by **59 %** by 2049).

Health Impacts

Air quality
Increased exposure to air pollutants and allergens
Respiratory diseases
Cardiovascular diseases, Heart attacks, strokes
Cancer

Temperature-related morbidity and mortality
Illness related to extreme cold and heat events
Respiratory and cardiovascular illnesses
Increased occupational health risks

Vector Borne contamination
Lyme Disease
West Nile Virus
Other exotic diseases?

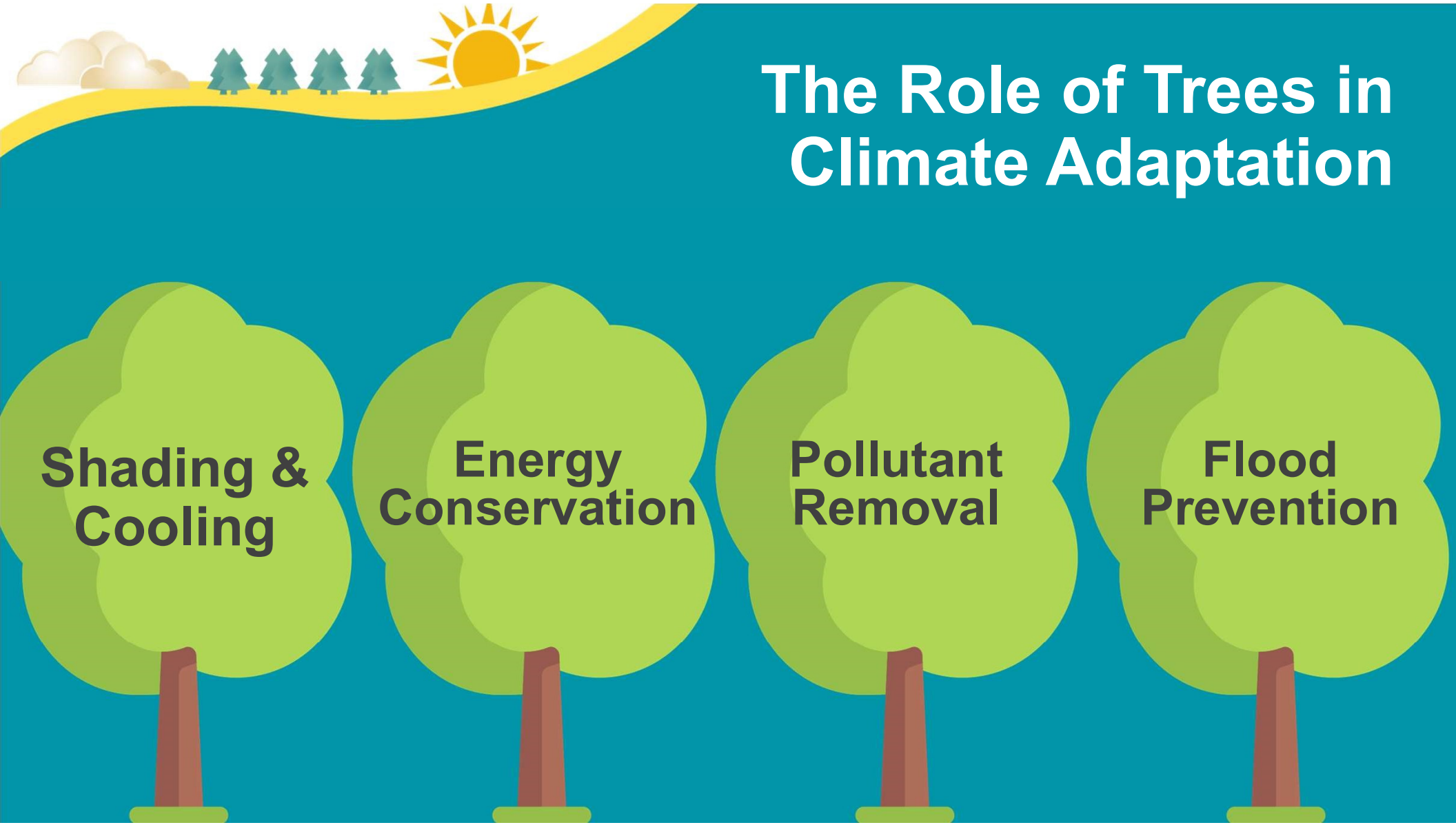
Weather-related natural hazards
Damaged infrastructure
Injuries and illnesses
Social and mental stress
Increased occupational health hazards
Population displacement

Exposure to ultraviolet rays
Skin damage and skin cancer
Cataracts
Disturbed immune function

Water- and food-borne contamination
Intestinal disorders and illnesses caused by chemical and biological contaminants

Impacted Populations

The Role of Trees in Climate Adaptation



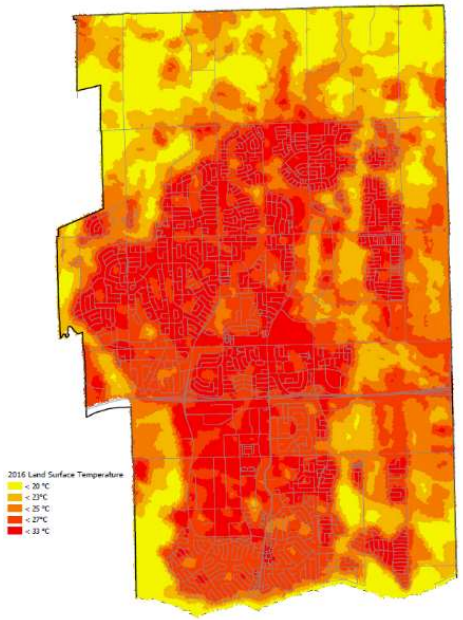
NASA Earth Observations to Assess Urban Forestry as an Adaptation Strategy for Extreme Heat in Ajax

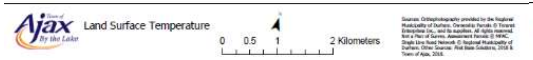
Utilizing NASA Earth Observations to Assess Urban Forestry as an Adaptation Strategy for Extreme Heat in Ajax

- VIDEO, REMOVED FOR PDF VERSION

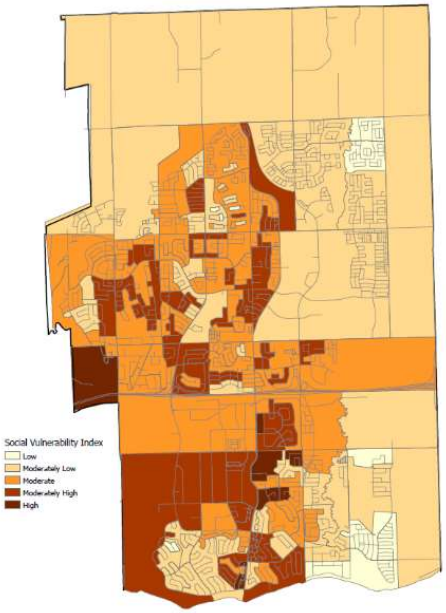
Model

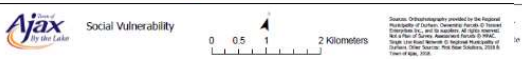
Surface Temp



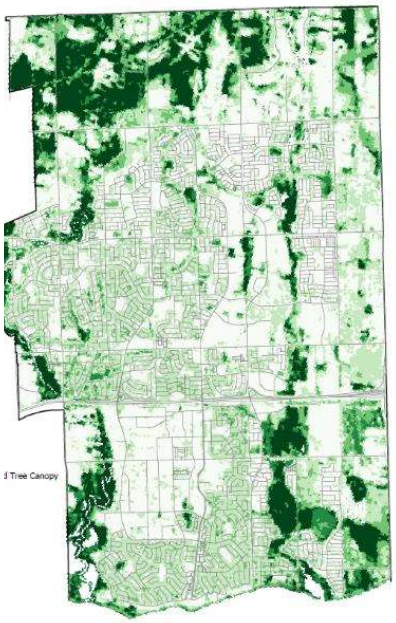


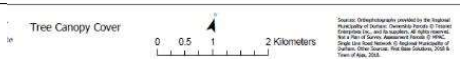
Social Vulnerability



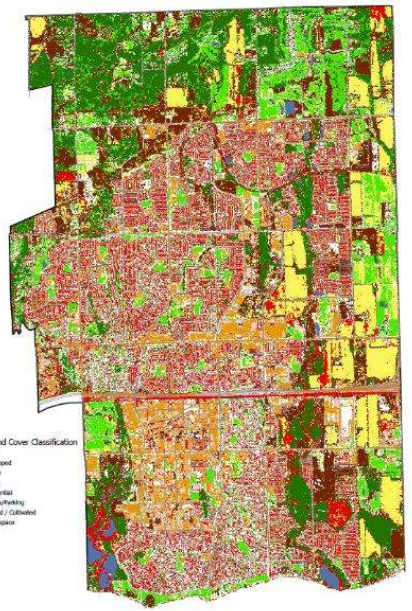


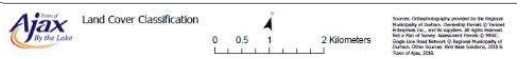
Forest Cover





Land Use





Solution:

Plant More Trees In Vulnerable Neighborhoods

But…..

Trees are susceptible to climate change:

- Drought
- Increased Ice
- Invasive Species
- Exposure to Diseases
- Winter Stratification
- Humans

Ajax's GIS Climate Vulnerability Model

Natural Capita

The potential vulnerabilities of natural capita assets in response to conditions predicted in the 2049 Durham Region climate model were assessed and evaluated.

Natural Capita Assets included within the model included:

MUNICIPAL TREES

WOODLAND AND WETLAND COMMUNITIES

OPEN SPACE

Municipal Tree Data

Ajax's Existing Municipal GIS Inventory data for trees found on boulevards and parks (*excluded private or woodlot trees*)

- Additional species added based on the presence of known ELC communities
- In total, 57 tree species were selected for analysis (93.3% of the total municipal trees within the Town's tree database)

1,455 trees in the data set were missing information (e.g. species name, etc.)

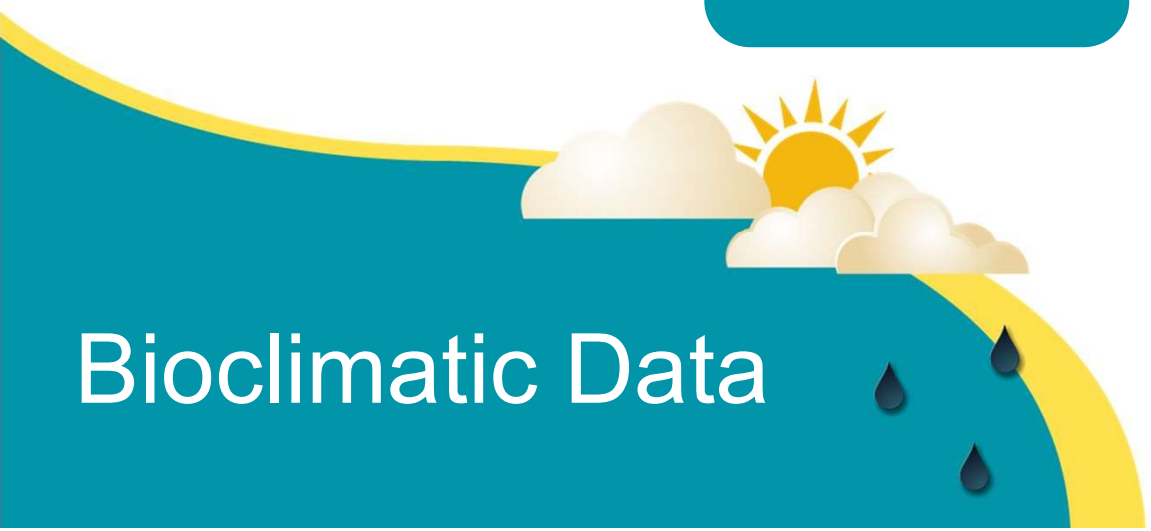
- These data points were removed from the data set

45.465 individual trees included in the Town data set

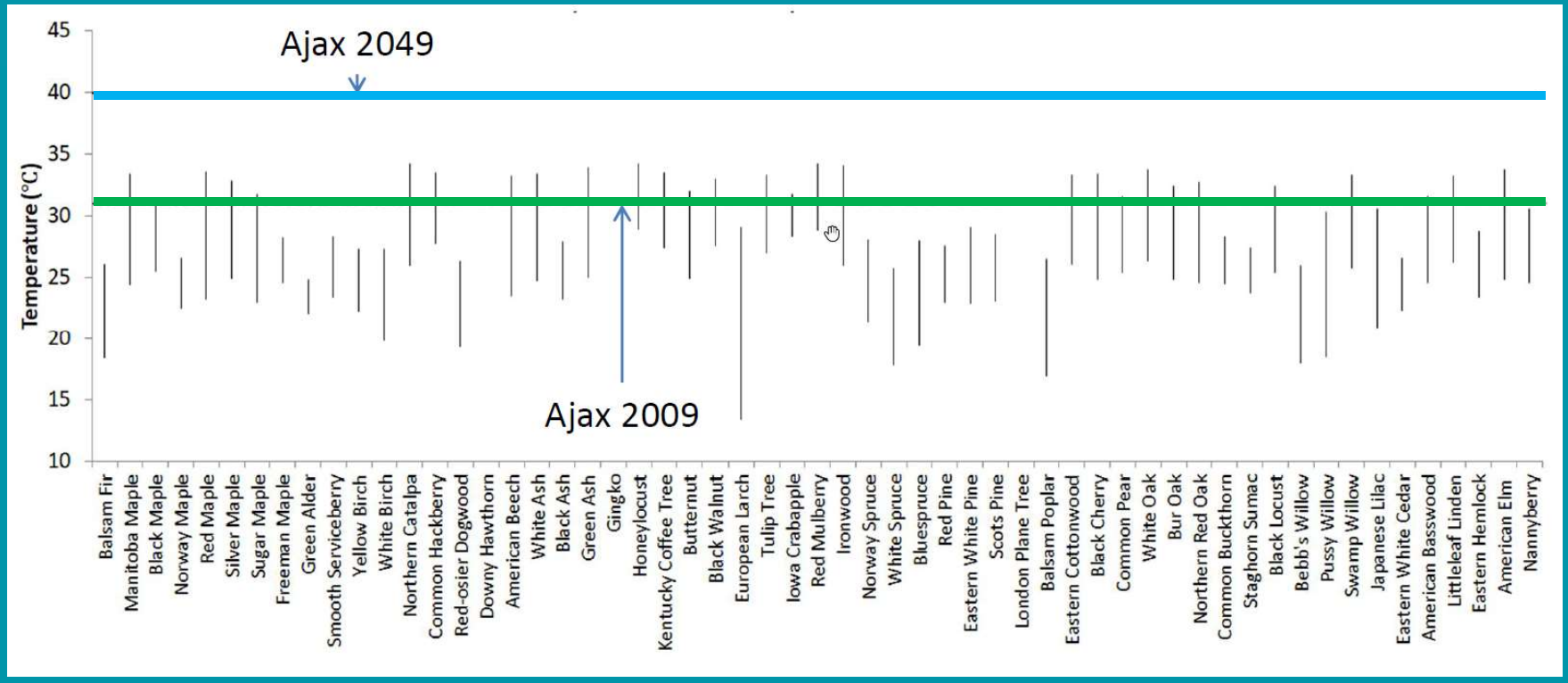
Bioclimatic Data

Six Natural Resource Canada bioclimatic variables were used in the model to represent the climate envelope of each tree species:

- ANNUAL MEAN TEMPERATURE
- MINIMUM TEMPERATURE OF THE COLDEST MONTH
- MAXIMUM TEMPERATURE OF THE WARMEST MONTH
- ANNUAL PRECIPITATION
- PRECIPITATION IN THE WARMEST QUARTER
- PRECIPITATION IN THE COLDEST QUARTER



Bioclimatic Envelopes- Maximum Temperature

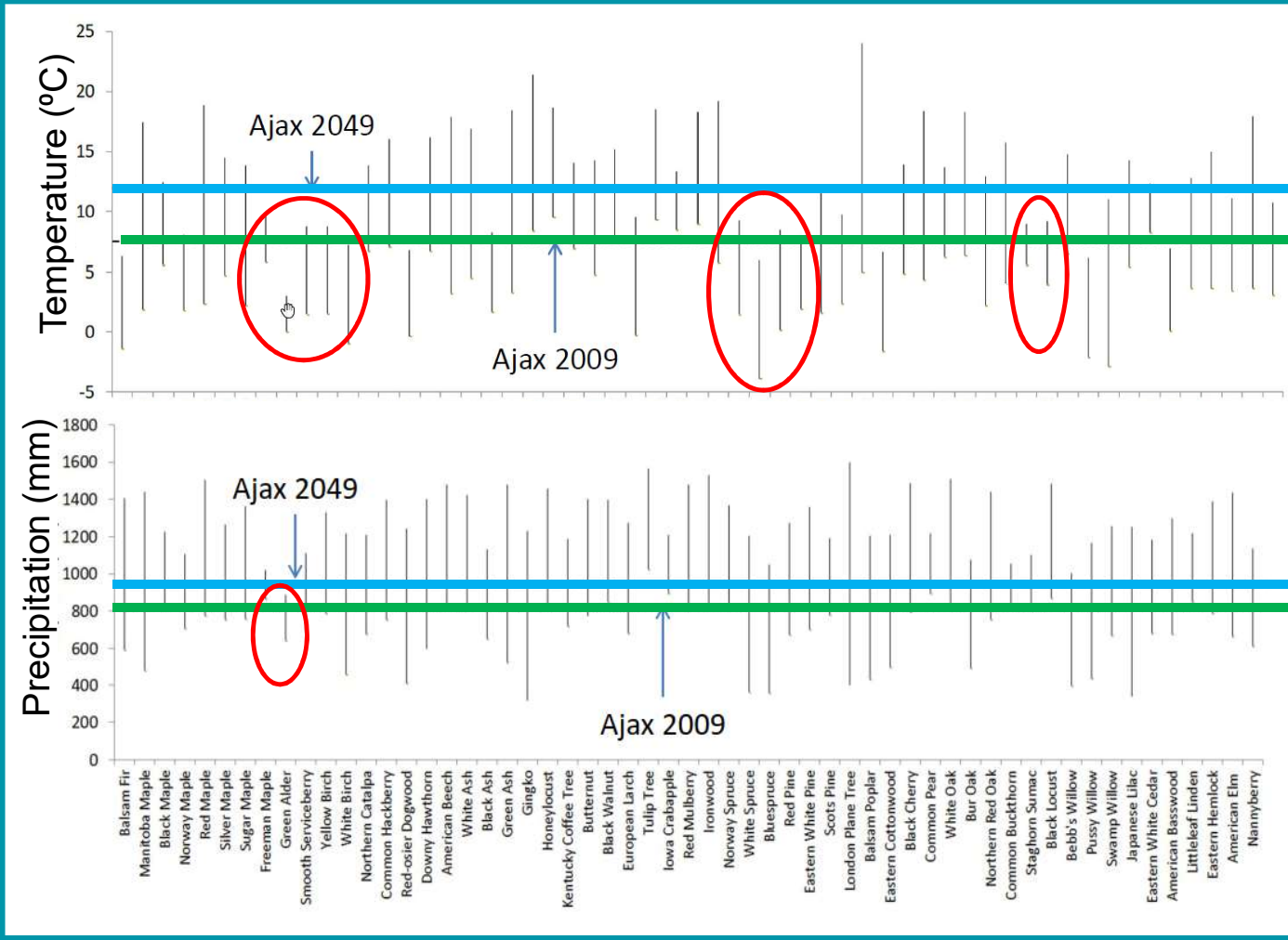


Trees assessed contained bioclimatic envelopes below the maximum predicted temperature (40 °C) according to the regional climate model.

Bioclimatic Envelopes

Several tree species had bioclimatic envelopes outside of the predicted mean <u>ANNUAL</u> temperature level:

- Eastern White Cedar
- Bebb's Willow
- Freeman Maple
- Green Alder
- Yellow Birch
- White Birch
- European Larch
- Norway Spruce
- White Spruce



CPA (estimated by dbh) are represented in individual trees by the size of circles.

Climate Vulnerability Score (Trees)

Legend

Ajax Town Trees CV

Climate_vulnerability_score_49

- >0.8 - 1
- >0.6 - 0.8
- >0.4 - 0.6
- >0.2 - 0.4
- 0 - 0.2

Ajax Town Trees CV Buffer

Climate_vulnerability_score_49

- 0.800001 - 1.000000
- 0.600001 - 0.800000
- 0.400001 - 0.600000
- 0.200001 - 0.400000
- 0.000000 - 0.200000

- The majority of individual trees did not demonstrate a moderate-high or high climate vulnerability score.
- These trees should be able to survive under projected climate conditions.

Climate Vulnerability Score (Tree Canopy & Infrastructure)

- Supplemental data provided to the Town can be queried to determine the location of salt tolerant tree species.

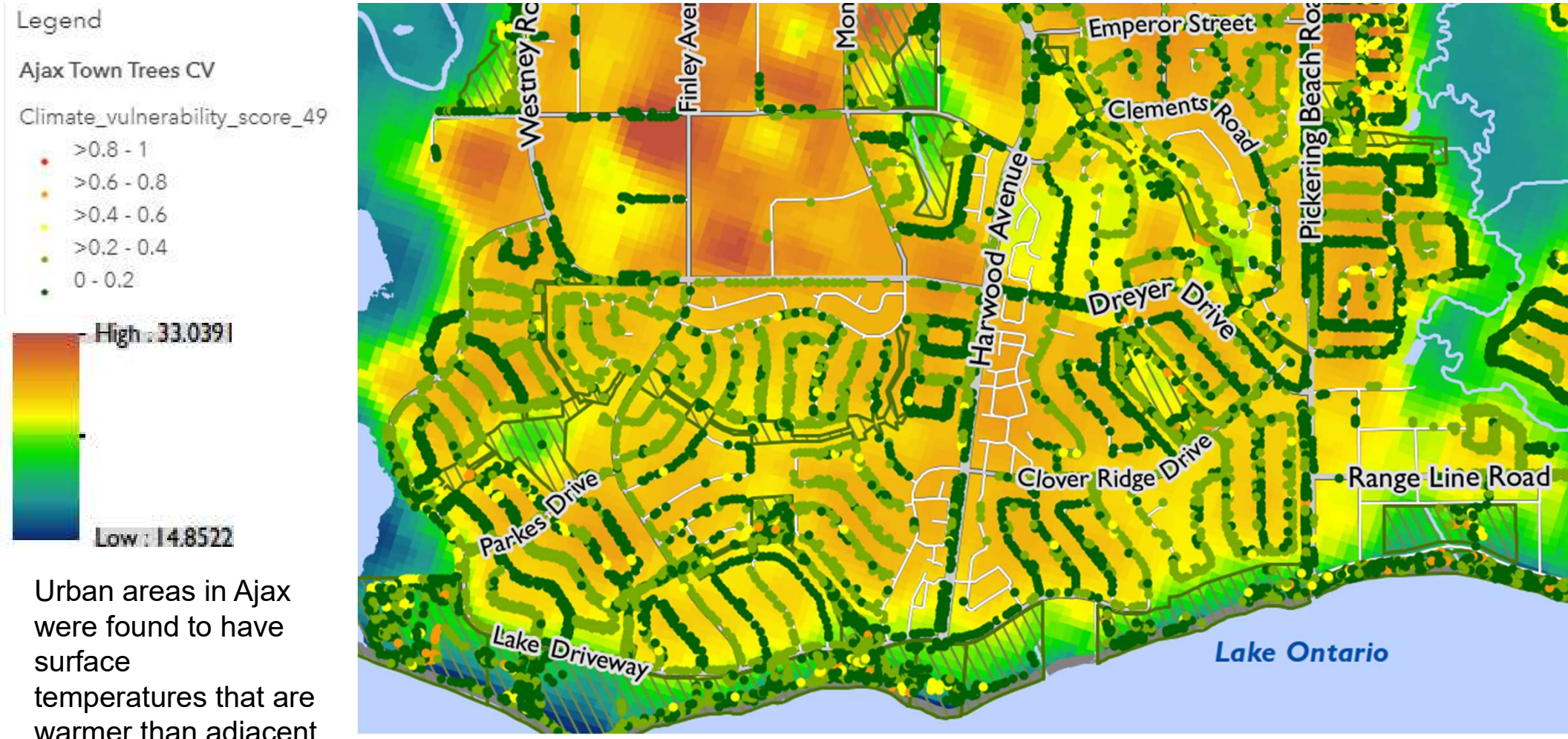
- **1 = salt tolerance**
- **0 = salt intolerant**

Climate Vulnerability Score (Salt Tolerance)

- Supplemental data provided to the Town can be queried to determine the location of drought tolerant tree species.

- **1 = drought tolerance**
- **0 = drought intolerant**

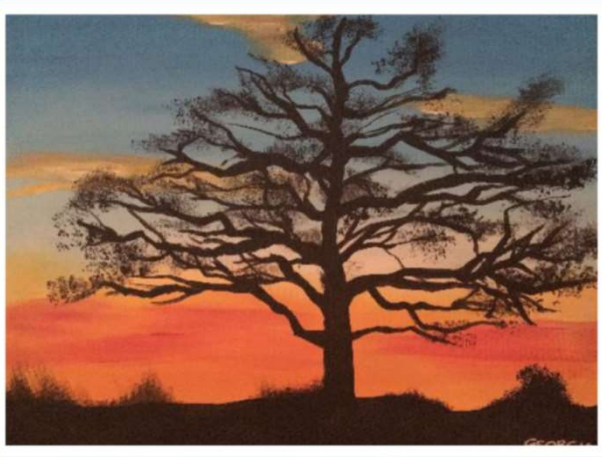
Climate Vulnerability Score (Drought Tolerance)



Urban areas in Ajax were found to have surface temperatures that are warmer than adjacent areas with vegetative cover.

Climate Vulnerability Score – Surface Air Temperature (Heat Island)

Findings



- Climate will be warmer, wetter and wilder by the late 2040's.
- The changing climate impacts many people.
- Clear relationship between surface temperature, tree coverage and population vulnerability.
- Trees are a tool to help us adapt to climate change but are also impacted by climate change.
  - Low - moderate vulnerability to urban forests (trees & natural areas)
  - Identified vulnerable trees with potential conflict with overhead infrastructure
  - Surface temperature (heat island effect) mapped in proximity to vulnerable trees & parks

Supporting Urban Forestry Management

- Identifies locations that exposed to extreme heat and would benefit most from planting efforts.
- Allows us to prioritize watering and additional forestry management efforts.
- Allows us to analyze tree arrangement at the subdivision scale.
- Forecasts potential tree stress based on projected changes in weather patterns including salt, drought and infrastructure conflicts.
- Estimate tree canopy cover and throughout Ajax and compare to the baseline UFORE study completed in 2009.

Acknowledgments

Ajax Climate Change Steering Committee:	Dillon Consulting:	NASA Develop:	ICLEI Canada:
• Jade Schofield • Craig Blencowe • Cayla Da Silva • Chris Walker • Danna Munns • Mark Somerville • Rick Chalmers • Sean McCullough • Stephen Ruddy	• Ravi Mahabir • Yena Ahadzie • David Restivo • Janny Pape • Geoff MacDonald • Christina Baker • Caitlin Vandermeer • Saloni Sood • Jaffer, Zahra • Michael Preston	• Lance Watkins • Huntington Keith • Eleanor Dhuyvetter • Dean Blumenfield • Elizabeth Dyer	• Meaghan Meany • Hana Lapp • Christina Schwantes

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THANK YOU

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Durham Region Natural Environment Climate Change Summit

Brought to you by: the Natural Environment Climate Change Collaborative, with support from the Region of Durham and Enbridge

thank you

thank you