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# Assessment of Vulnerability to the Health Impacts of Climate Change in Middlesex London Region

## Advisory Committee on Environment (ACE)

**February 4, 2015**

**By Iqbal Kalsi**

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# Environmental Health Chronic Disease's Mission

We are public health professionals who embrace opportunities that promote the prevention of chronic disease and injuries through evidence-based practice, innovative leadership, dynamic partnerships, and effective communications.

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# Goal of EHCD

To protect and promote the health of people within our community through the implementation of public health programs that focus on environmental health, chronic diseases and injury prevention.

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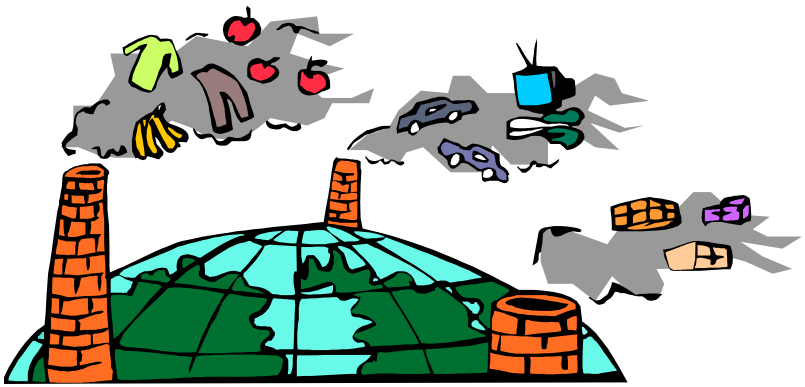
# Health Hazard Management and Prevention



- Environmental Health Hazards
- Toxicology & Risk Assessments
- Non-communicable disease investigations
- Climate Change &Health
- Air Quality & Health & Anti-idling
- School health and environment issues
- Land Use Planning
- Emergency Response
- Special Risks Program
- Contaminated Site & PCB Waste Cleanup and Blood Study
- ***Etc…***

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"Climate change is the biggest global health threat of the 21st century"

Lancet and UCL, 2009

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In Canada, average national temperatures have increased 1.2°C over the past 50 years and an even greater rate of warming is projected over this century.

(Government of Canada, 2006)

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# According to Natural Resources Canada(2007)

*…Southwestern Ontario region, where Middlesex-London is located is expected to experience increases in temperature, precipitation and more extreme weather (e.g. storms and resulting flooding)…..*

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By 2050 SW Ontario temperatures are anticipated to increase by 2° to 4° C, largest in winter months

(Bruce 2011)

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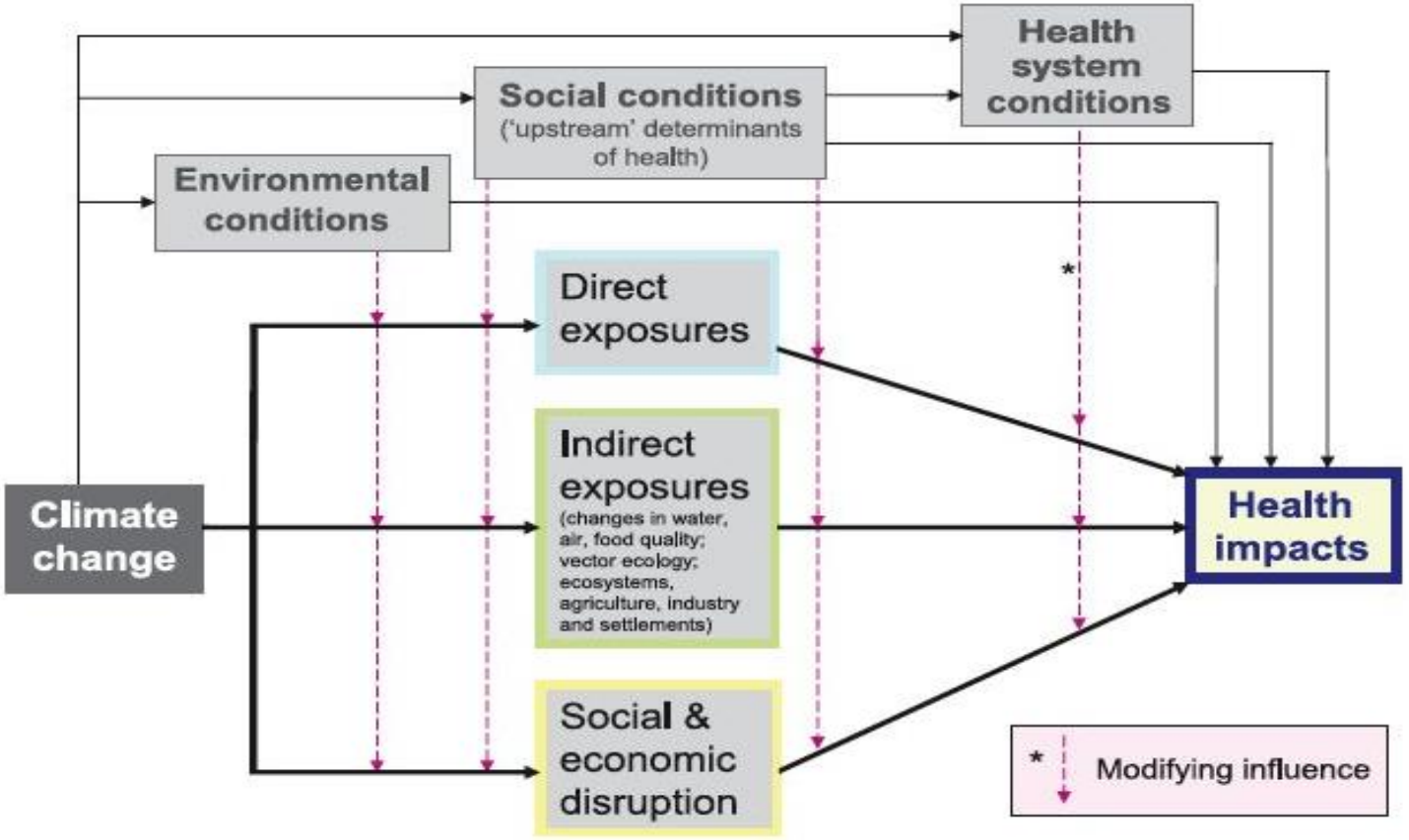
# Pathways by which climate change impacts health, and the concurrent influences of environmental, social and health system factors




Source: Confalonieri et al 2007 Climate Change 2007

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# Role of Public Health in Changing Climate

- Increase knowledge & awareness and prevent diseases and deaths related to Changing Climate
- Direct health affects include increased morbidity and mortality issues from extreme weather events e.g. extreme heat, floods, hurricanes, ice storms, droughts…
- Indirect health affects include increases in acute respiratory and cardiovascular diseases related to poor air quality, food & waterborne and vector-borne & zoonotic diseases….

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# Under these circumstances

- health risks from climate change are growing for people living in Middlesex-London.

- economic costs are also expected to be significant due to increased pressures on health and social services.

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# Therefore, …

To ascertain our vulnerability to climate change, we partnered with Health Canada (Climate Change Health Office) to conduct a baseline vulnerability assessment

This assessment will be used to guide future climate change adaptation strategies in Middlesex-London

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# Objective

To report results of an assessment of vulnerability of people living in Middlesex-London to the health impacts of climate change.

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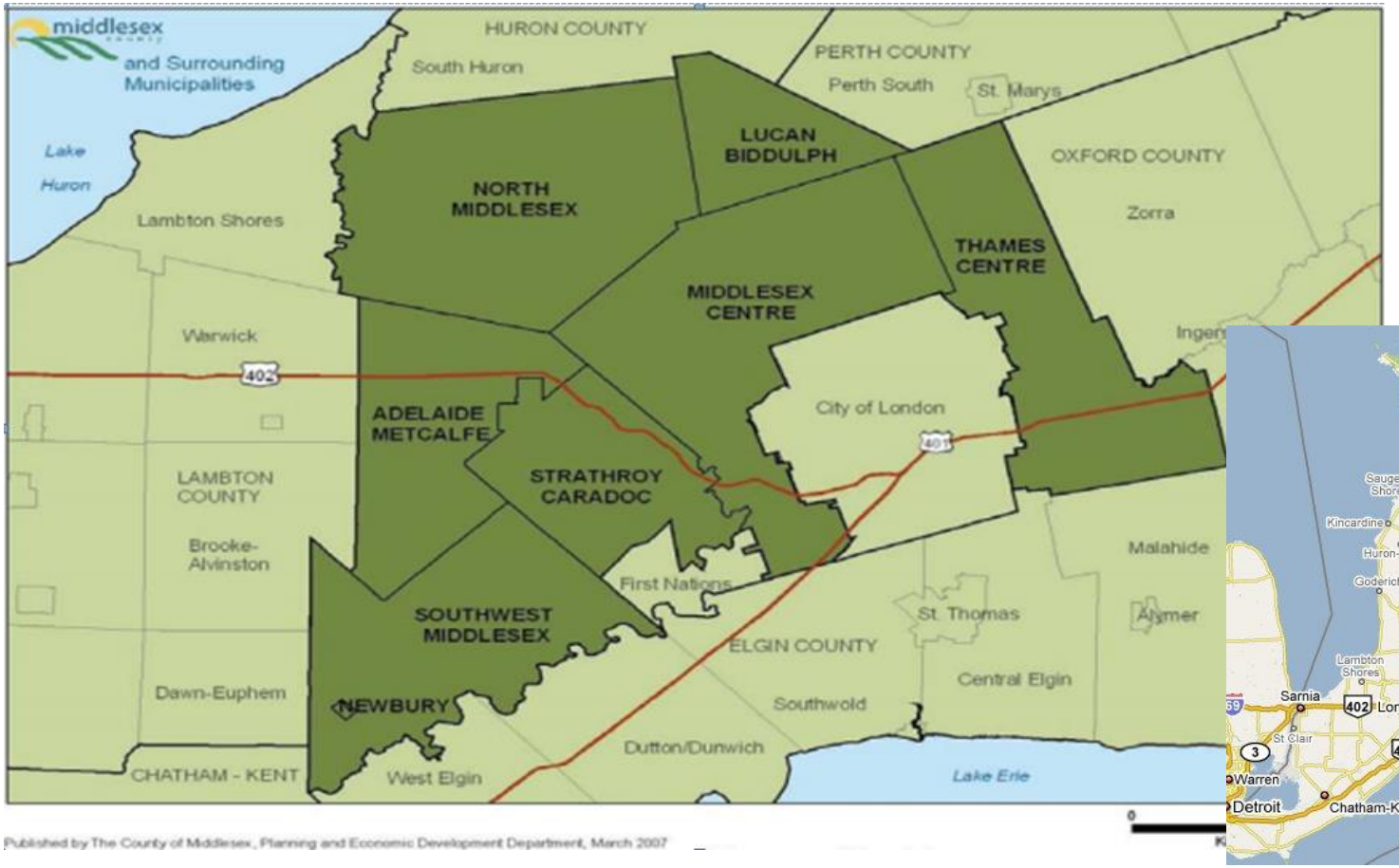
# Middlesex-London Area





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# Middlesex-London Area

- Consist of City of London & Middlesex Counties (eight rural municipalities)
- Covering 3317 square kilometers
- MLHU population is 439,151(2011) around 25.2 people/ sq.km
- City of London is 11th largest municipality in Canada with 366,151population around 132.4 people/sq.km

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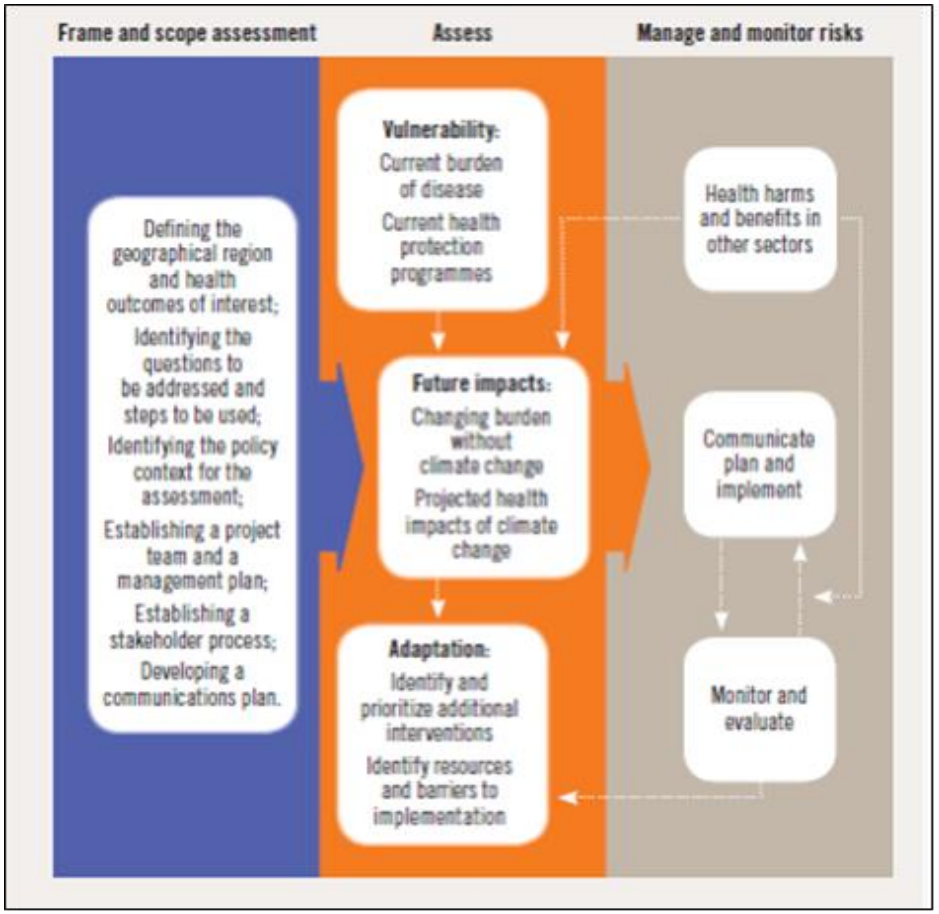
# Methodology

- **For assessment methods we used World Health Organization and Pan American Health Organization (2012) approach**
- **A scientific literature review and analysis of community health and meteorological data;**
- **Projections of future climate conditions;**
- **A community workshop to examine vulnerable populations and capacity to adapt.**




Source: WHO/PAHO,2012

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# Vulnerability ….

… ***"the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes"***

(IPCC 2007, p.21).

**Vulnerability is a function of …**

- **EXPOSURE**
- **SENSITIVITY**
- **ADAPTIVE CAPACITY**

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# Function of Vulnerability Risk Assessment

- Exposure of our population living in Middlesex-London to Climate Change Hazards …
- Determine threats to human health,
- Establish plans for climate change adaptation
- Promote the health of community through wide array of program & policy initiatives that would prevent morbidity and mortality

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# Exposure Indicators…

- Extreme Heat and Cold Events
- Air Pollution
- Vector-Borne Disease
- Water-Borne Illness
- Food-Borne Illness
- Ultra Violet Radiation
- Food Security
- Floods

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# Local Impacts …

- **In Southwestern Ontario temperatures are anticipated to increase between 2 to 4°C by 2050 with largest increase in the winter**
- **Warming temperatures will likely impact wind & river flows**
- **Intense winter storms with high winds to increase by 8-15%**
- **Spring ice break-up on rivers is expected to occur earlier**
- **Flooding**
- **Increase poor air quality events**
- **Tornados increase in frequency**
- **Intensity of precipitation increasing (Bruce 2011)**

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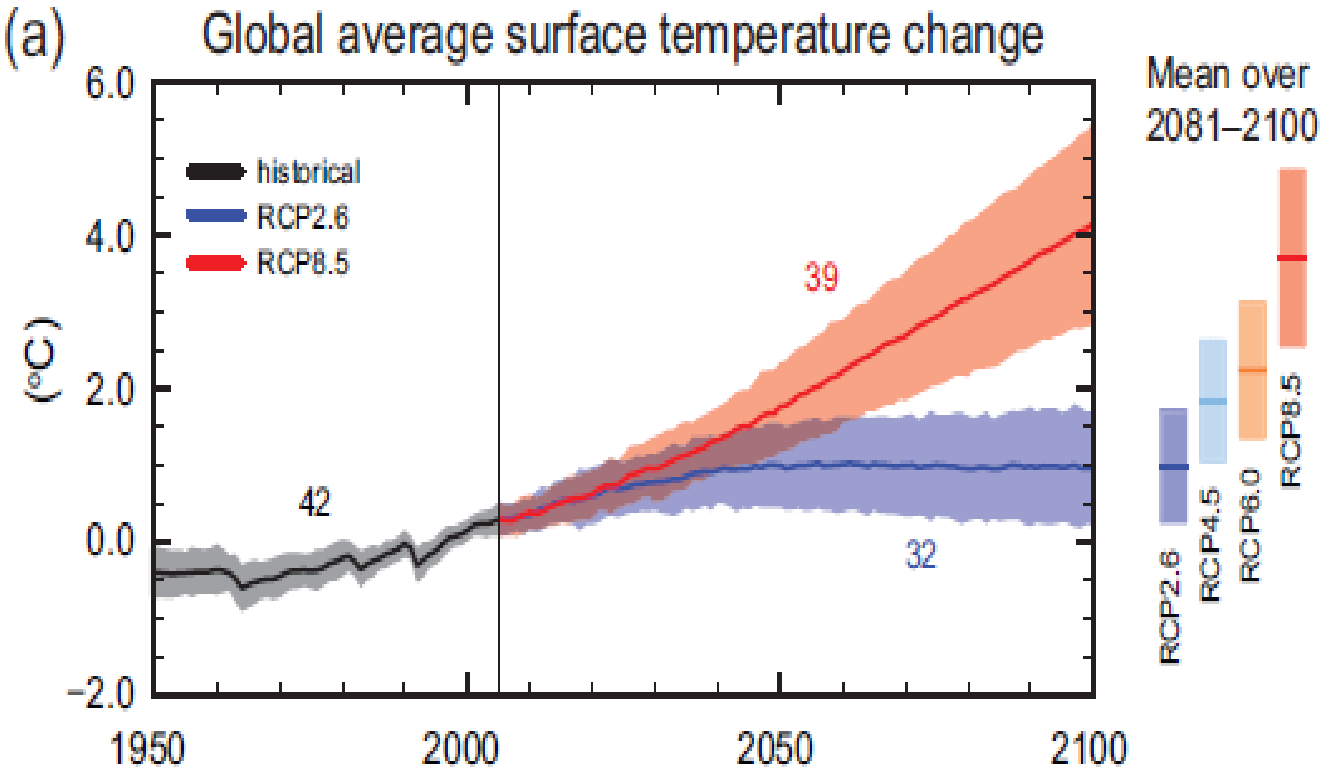
# Future Climate Projections
## (AR5 - IPCC 2013)

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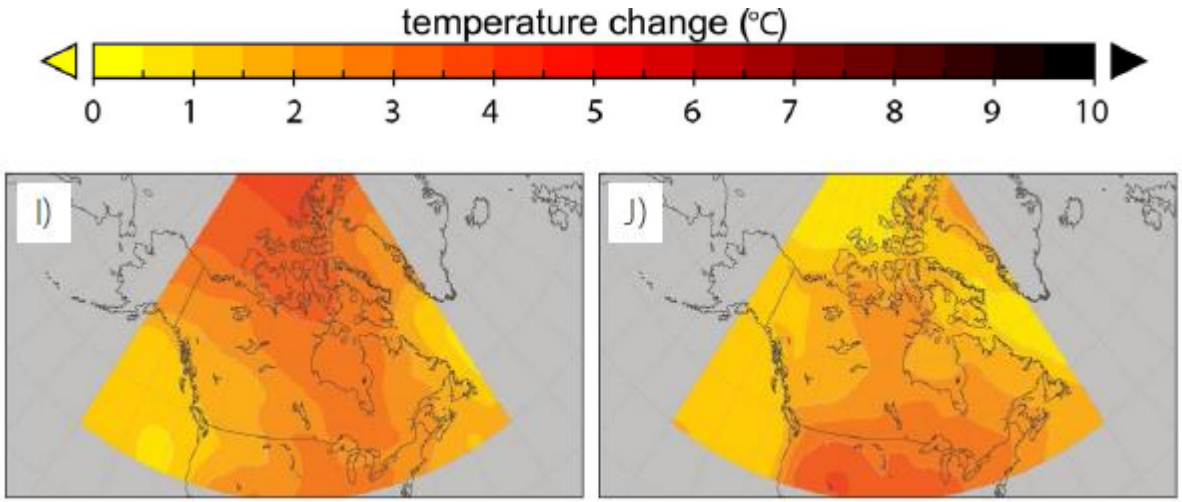
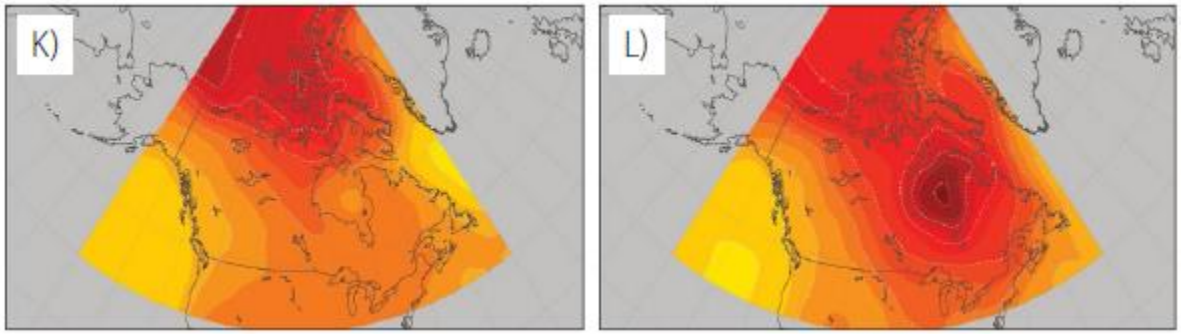
## Projected seasonal changes in surface air temperature (°C) 2050s in spring (I) and summer (J)




## Projected seasonal changes in surface air temperature (°C) 2050s in autumn (K) and winter (L)




Source: Bush et al., 2014

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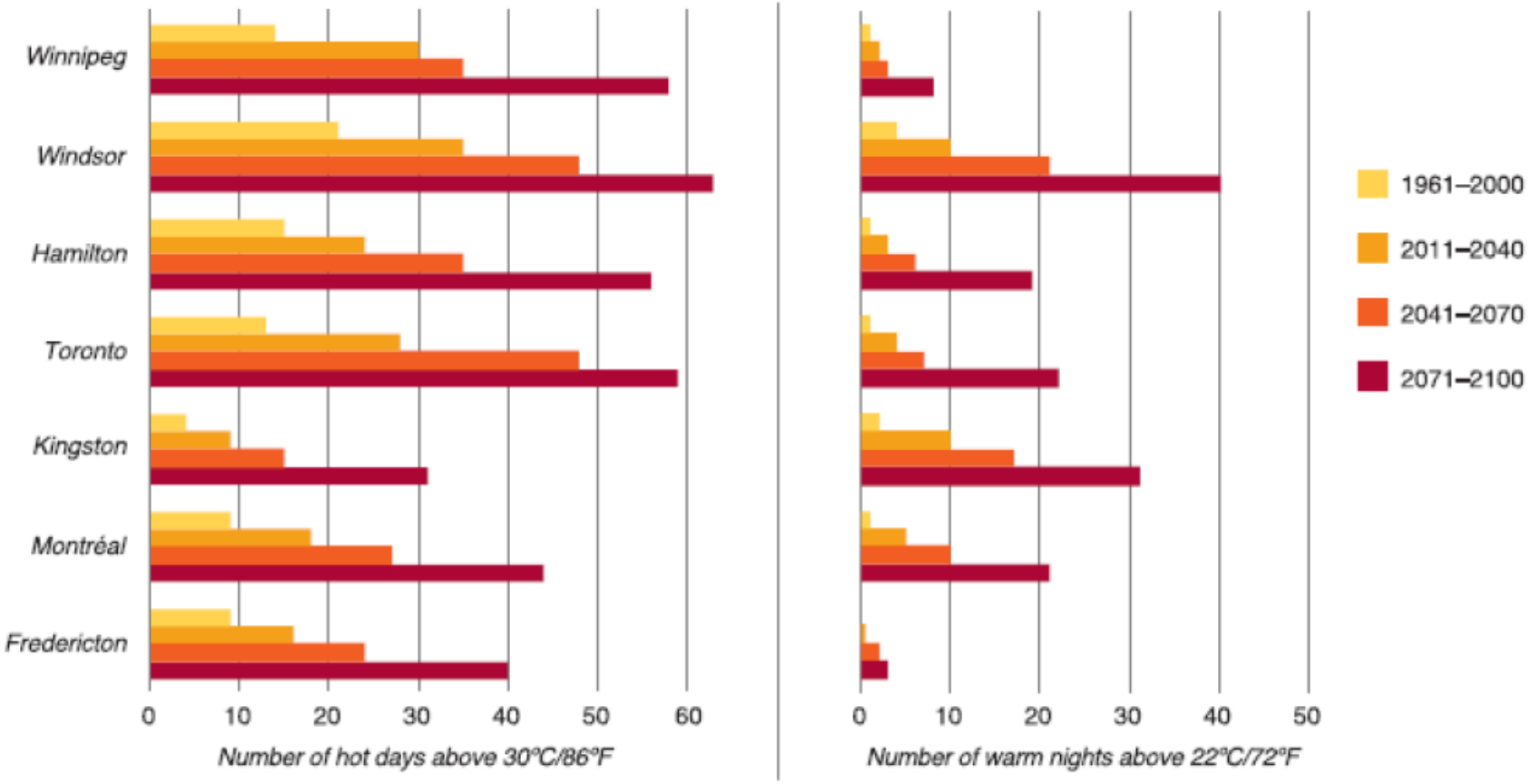
# Projected Extreme Temperature Risks to Health in Canada

Historical and projected number of hot days and warm nights for selected cities in Canada




SOURCE: Casati, B. and Yagouti, A. / Health Canada

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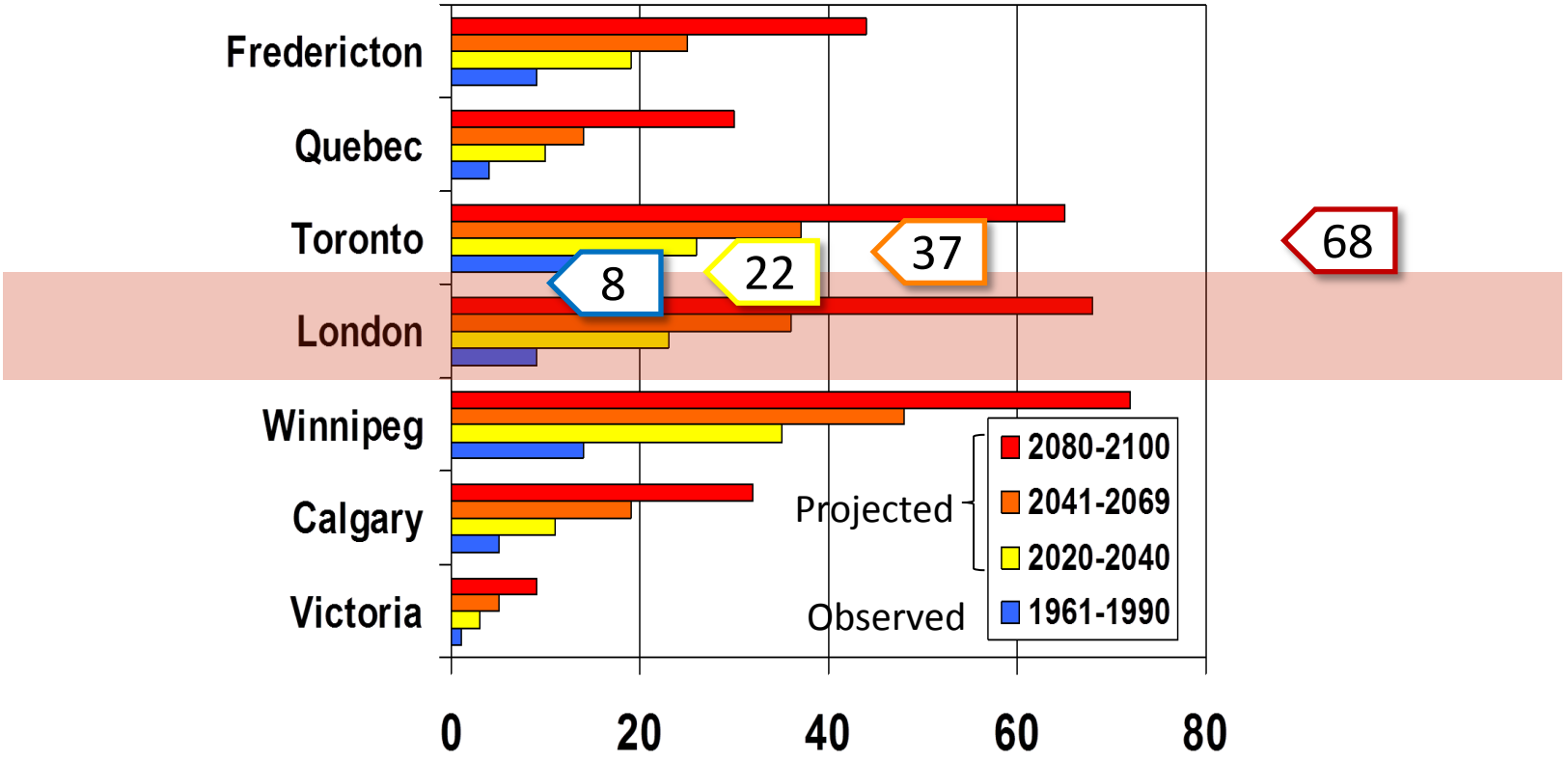
# NUMBER OF HOT DAYS* PER YEAR




**Canadian Centre for Climate Modelling and Analysis**

*A hot day is defined as a day with a maximum temperature above 30C

Environment Canada Environnement Canada

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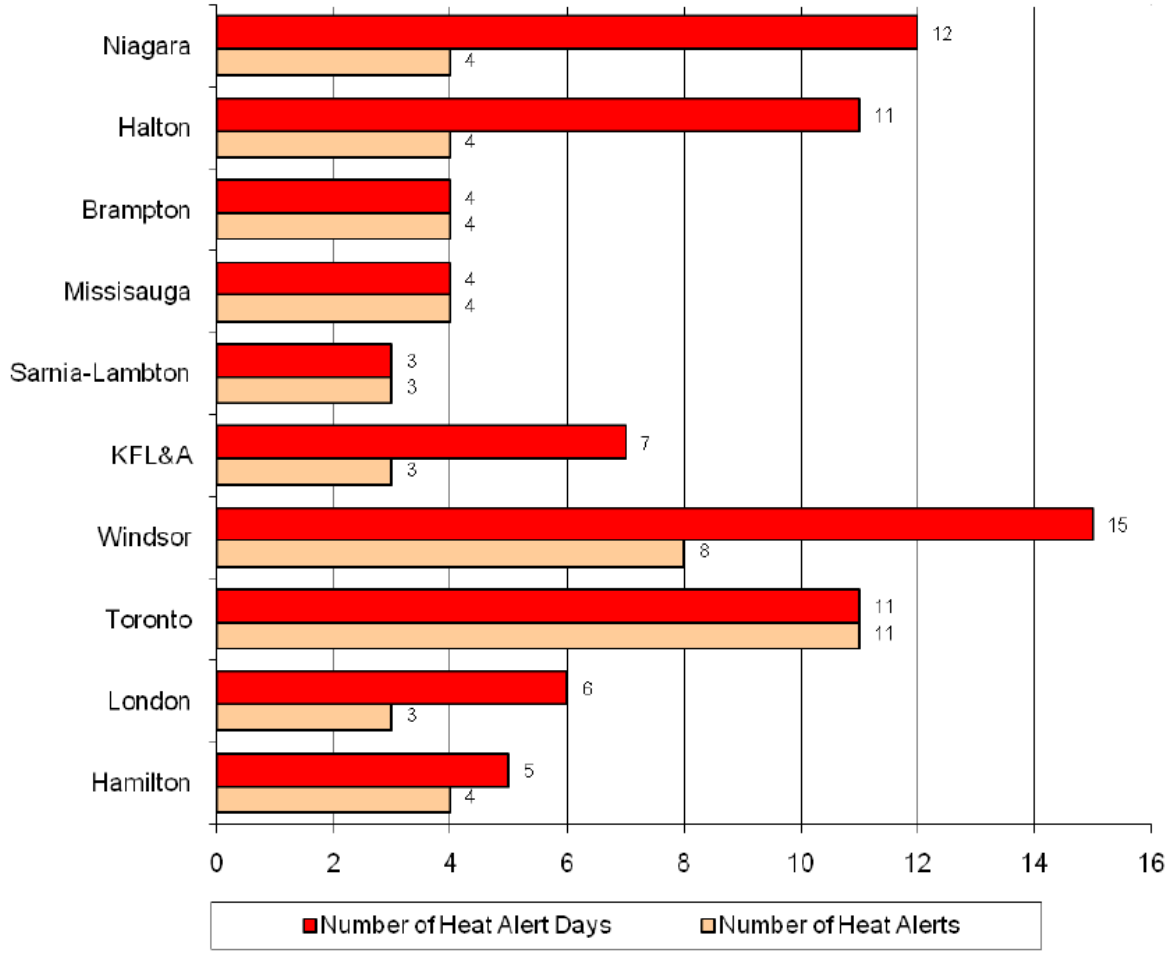
# Projected Risks to Health in Canada




SOURCE: Casati, B. and Yagouti, A. / Health Canada

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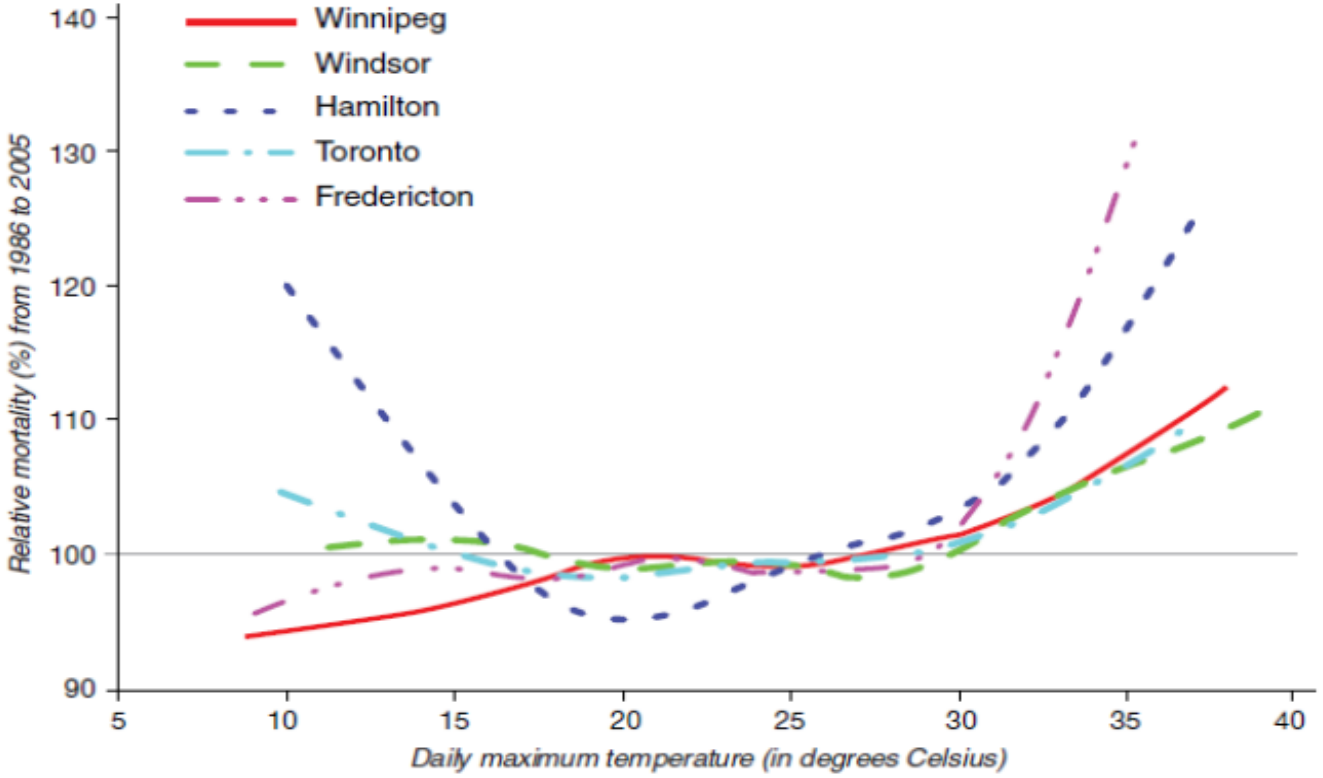
# Evidence of Health Impacts from Extreme Heat Temperatures

Relationship between daily maximum temperatures in June, July and August, and all non-traumatic deaths from selected Canadian cities. (1986 – 2005)




SOURCE: Casati, B. and Yagouti, A. / Health Canada

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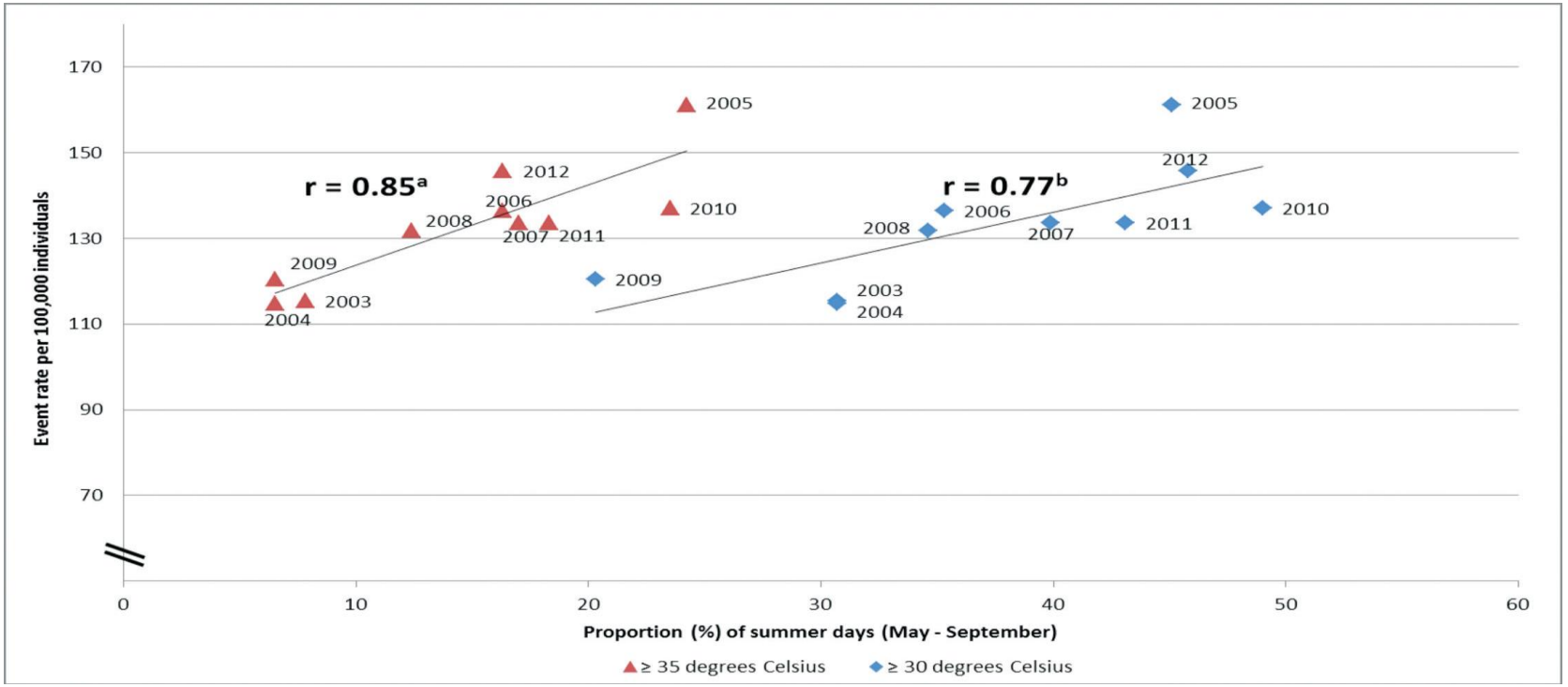
# Association between heat-stress morbidity and summer humidex values in the Middlesex-London Region, 2003-2012




Source: Shariff et al., 2014

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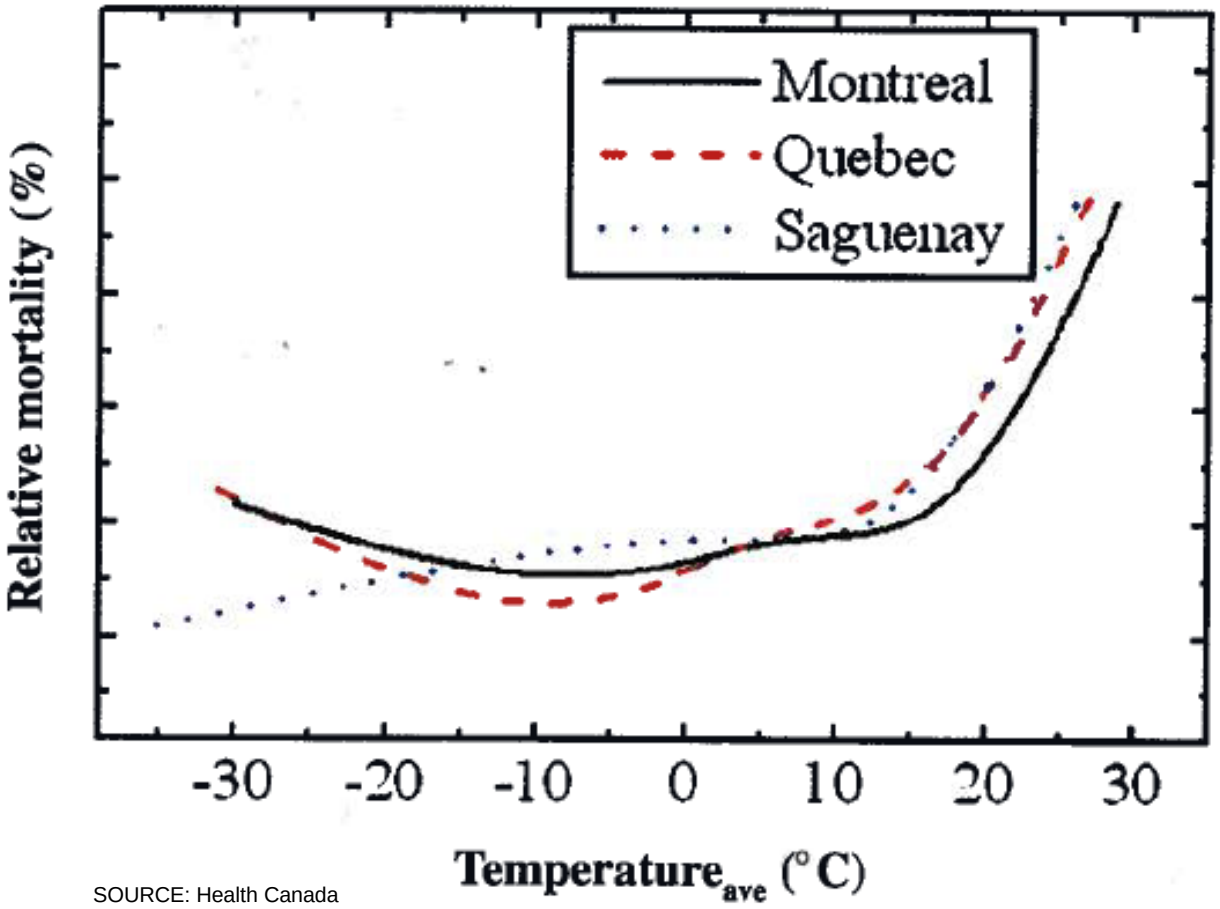
# Temperature-mortality Relationships for Montreal, Quebec City and the Saguenay Region




SOURCE: Health Canada

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## Historical temperature comparison for Middlesex-London, 1971-2000 vs. 2001-2012

| | Mean Daily Tmax (°C) | | Mean Daily Temperature (°C) | | Mean Daily Tmin (°C) | |
|---|---|---|---|---|---|---|
| | 1971-2000 | 2001-2012 | 1971-2000 | 2001-2012 | 1971-2000 | 2001-2012 |
| January | -2.4 | -1.6 | -6.3 | -5.2 | -10.1 | -8.8 |
| February | -1.4 | -0.8 | -5.5 | -4.8 | -9.7 | -8.7 |
| March | 4.2 | 5.2 | -0.3 | 0.6 | -4.7 | -4.1 |
| April | 11.6 | 13.2 | 6.3 | 7.6 | 1 | 1.9 |
| May | 19 | 19 | 13 | 13.3 | 7 | 7.6 |
| June | 23.8 | 24.5 | 18 | 18.9 | 12.1 | 16.9 |
| July | 26.3 | 27.1 | 20.5 | 20.4 | 14.6 | 16.4 |
| August | 25.2 | 26.2 | 19.5 | 19.9 | 13.7 | 15.2 |
| September | 20.9 | 22.3 | 15.3 | 16.1 | 9.6 | 11.2 |
| October | 14 | 14.6 | 9 | 9.8 | 4 | 5 |
| November | 6.9 | 8.5 | 3.1 | 4.2 | -0.7 | 0.8 |
| December | 0.6 | 1.3 | -3 | -2.2 | -6.5 | -4.9 |

## Historical extreme heat and cold for Middlesex-London, 1971-2000 vs. 2001-2012

| | Days with Humidex >= 30°C | | Record Daily Tmax in °C (Year/Day) | | Days with Wind Chill =< -20°C | | Record Daily Tmin in °C (Year/Day) | |
|---|---|---|---|---|---|---|---|---|
| | 1971-2000 | 2001-2012 | 1900-2000 | 2001-2012 | 1971-2000 | 2001-2011 | 1900-2000 | 2001-2011 |
| January | 0 | 0.0 | 16.7 (1950/25) | 14.8 (Twice) (2005/13; 2008/7) | 10.2 | 7.8 | -31.7 (1970/24) | -27.1 (2005/25) |
| February | 0 | 0.0 | 17.8 (2000/26) | 13.2 (2002/25) | 7.7 | 5.6 | -29.5 (1978/04) | -25.6 (2009/5) |
| March | 0 | 0.1 | 24.8 (1998/30) | 27.2 (2012/22) | 2.1 | 1.4 | -24.8 (1978/02) | -25.6 (2003/3) |
| April | 0.3 | 0.3 | 29.4 (1990/25) | 28.2 (2002/16) | 0.1 | 0.0 | -12.2 (1965/03) | -12.4 (2003/6) |
| May | 3.1 | 3.3 | 32.4 (1987/30) | 33.1 (2006/29) | 0 | 0.0 | -5 (1947/10) | -2.8 (2002/19) |
| June | 9.7 | 12.3 | 38.2 (1988/25) | 33.4 (2005/27) | 0 | 0.0 | -0.6 (1972/11) | 3.8 (2003/1) |
| July | 16.9 | 20.5 | 36.7 (1941/27) | 36.7 (2011/21) | 0 | 0.0 | 5 (1963/09) | 5.9 (2001/2) |
| August | 15 | 15.5 | 37 (2001/08) | 37 (2001/8) | 0 | 0.0 | 1.5 (1982/29) | 6.1 (2004/22) |
| September | 5.6 | 6.3 | 34.4 (1953/01) | 34.2 (2002/9) | 0 | 0.0 | -3.3 (1965/27) | 2 (2001/26) |
| October | 0.3 | 0.8 | 30 (1946/06) | 30.3 (2007/8) | 0 | 0.0 | -11.1 (1969/23) | -5.2 (2002/31) |
| November | 0 | 0.0 | 24.4 (1950/01) | 19.6 (2008/6) | 0.1 | 0.8 | -18.3 (1951/06) | -13.5 (2008/23) |
| December | 0 | 0.0 | 18.5 (1982/03) | 16.4 (2001/5) | 4.2 | 1.8 | -26.9 (1977/11) | -22.7(2004/20) |

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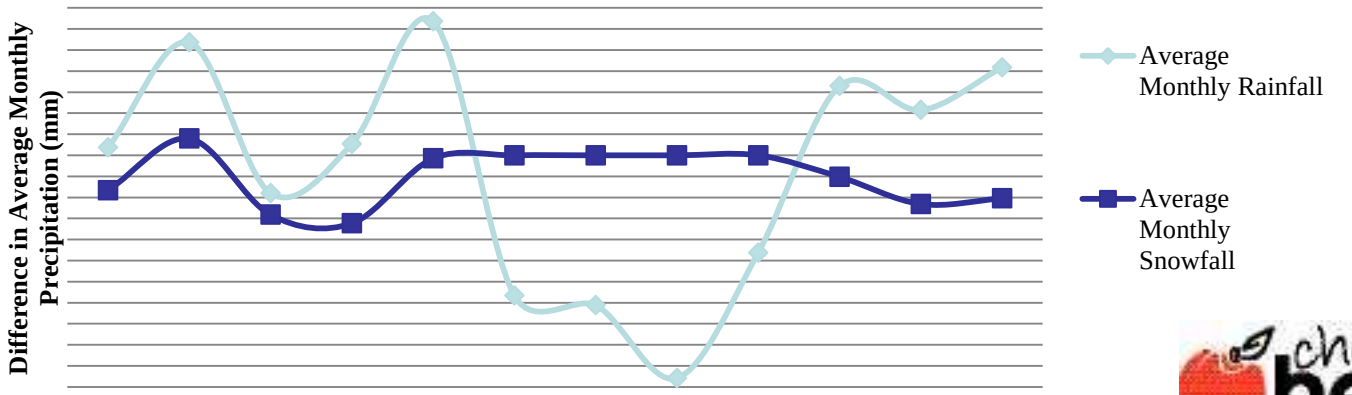
## Historical precipitation for Middlesex-London, 1971-2000 vs. 2001-2012

| Month | Average Monthly Rainfall (mm)* | | | Average Monthly Snowfall (cm)* | | | Record Daily Rainfall in mm (date) | Record Daily Snowfall in cm (date) |
|---|---|---|---|---|---|---|---|---|
| | 1971-2000 | 2001-2012 | Difference | 1971-2000 | 2001-2012 | Difference | | |
| January | 31.1 | 31.8 | 0.7 | 52.6 | 49.3 | -3.3 | 45 (1993/04) | 32.5 (1943/03) |
| February | 29.1 | 39.8 | 10.7 | 38.1 | 39.7 | 1.6 | 58.8 (1990/22) | 30 (1965/25) |
| March | 53.8 | 50.2 | -3.6 | 28.6 | 23.0 | -5.7 | 43.2 (1942/27) | 27.4 (1947/25) |
| April | 73.8 | 74.9 | 1.1 | 9.2 | 2.7 | -6.5 | 66.4 (2000/20) | 21.8 (1975/03) |
| May | 82.6 | 95.3 | 12.7 | 0.3 | 0.0 | -0.3 | 58.2 (1996/20) | 5.8 (1961/02) |
| June | 86.8 | 73.5 | -13.3 | 0.0 | 0.0 | 0.0 | 82.8 (2000/11) | 0.0 |
| July | 82.2 | 68.0 | -14.2 | 0.0 | 0.0 | 0.0 | 63 (1942/05) | 0.0 |
| August | 85.3 | 64.1 | -21.2 | 0.0 | 0.0 | 0.0 | 69.9 (1940/29) | 0.0 |
| September | 97.7 | 88.5 | -9.2 | 0.0 | 0.0 | 0.0 | 89.1 (1986/29) | 0.0 |
| October | 74.9 | 81.5 | 6.6 | 2.7 | 0.7 | -2.1 | 56.9 (1954/15) | 15.7 (1948/17) |
| November | 73.7 | 78.0 | 4.3 | 19.7 | 15.1 | -4.6 | 56.5 (1987/25) | 40.6 (1970/24) |
| December | 47.0 | 55.4 | 8.3 | 51.1 | 47.0 | -4.1 | 45.6 (1990/29) | 57 (1977/07) |

## Difference in monthly average precipitation for Middlesex-London: 1971-2000 vs. 2001-2012

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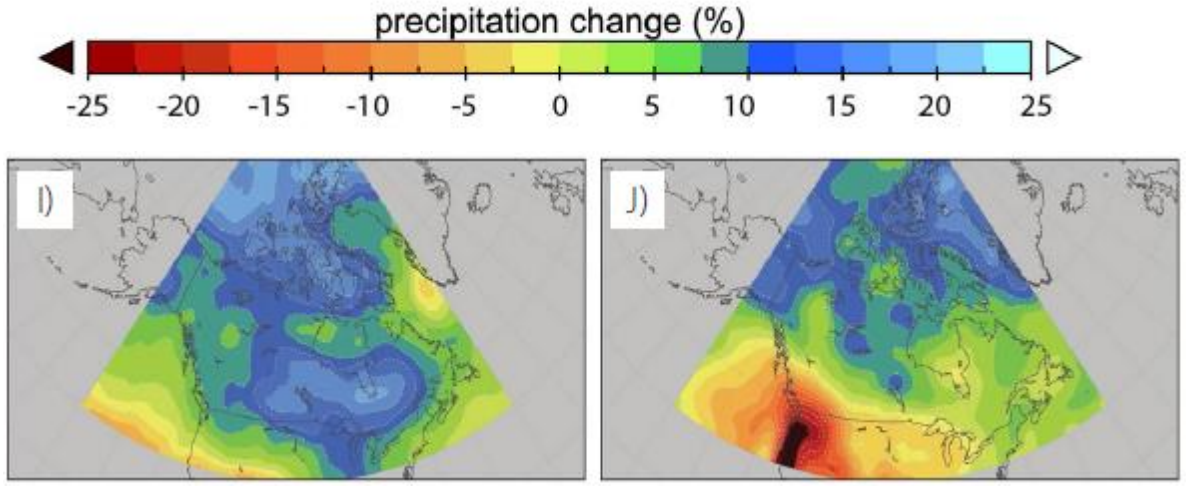
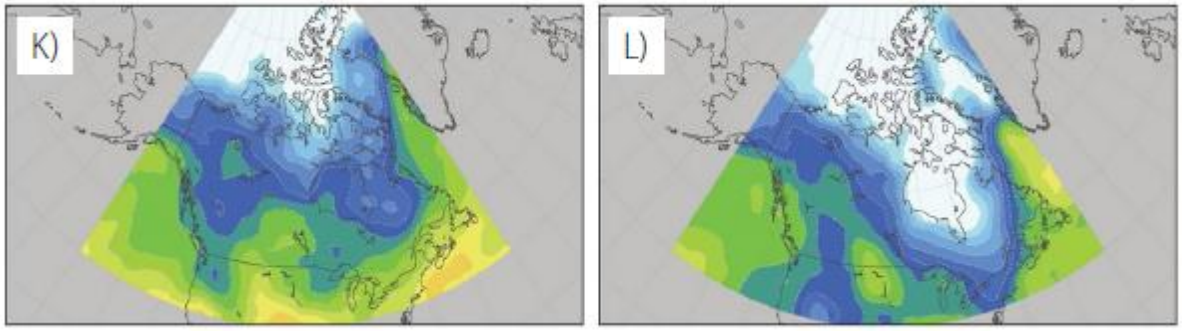
## Projected seasonal changes in precipitation (%) 2050s in spring (I) and summer (J)




## Projected seasonal changes in precipitation (%) 2050s in autumn (K) and winter (L)




Source: Bush et al., 2014

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## Population and dwelling counts in the City of London affected by flooding under different climate scenarios

| Flood Line | Climate Scenario | No. of Homes Flooded | No. of Buildings Flooded | Proportion Affected (2006 census data) | |
|---|---|---|---|---|---|
| | | | | Population | Dwellings |
| 100-year | Historic | 1141 | 34 | 7701 | 3969 |
| | Dry | 68 | 18 | 4881 | 2521 |
| | Wet | 1249 | 42 | 7949 | 4109 |
| 250-year | Historic | 1376 | 58 | 8474 | 4381 |
| | Dry | 1059 | 33 | 7351 | 3802 |
| | Wet | 1486 | 59 | 8745 | 4543 |
| 500-year | Historic | 1560 | 71 | 9119 | 4740 |
| | Dry | 1155 | 36 | 7717 | 3988 |
| | Wet | 1690 | 83 | 9388 | 4886 |

Table 1: Neighbourhoods in London, ON with a history of basement flooding

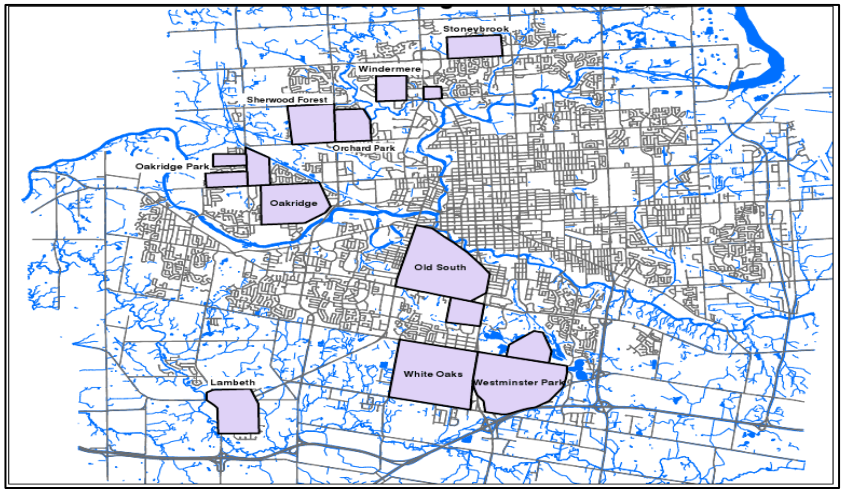
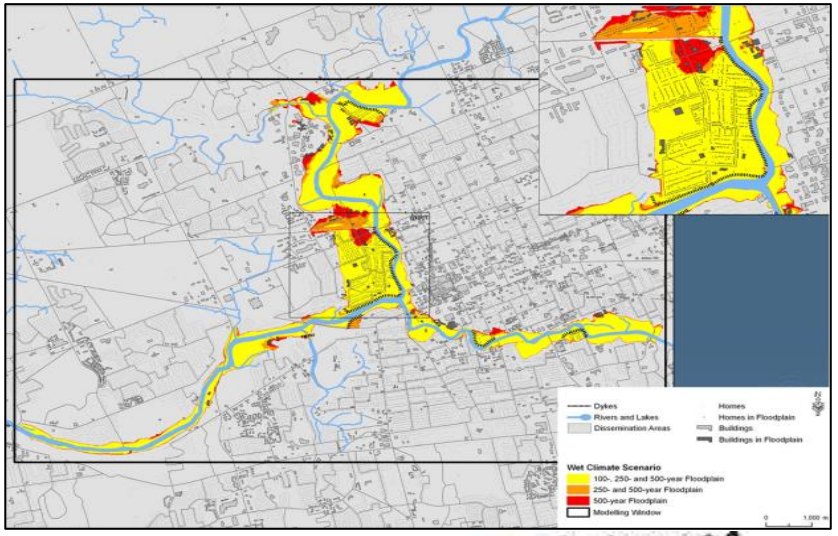



Table 2: City of London 100-, 250- and 500-year floodplains under various climate change scenarios




Source: MLHU (2013) & Source: Adapted from Hebb and Mortsch, 2007.

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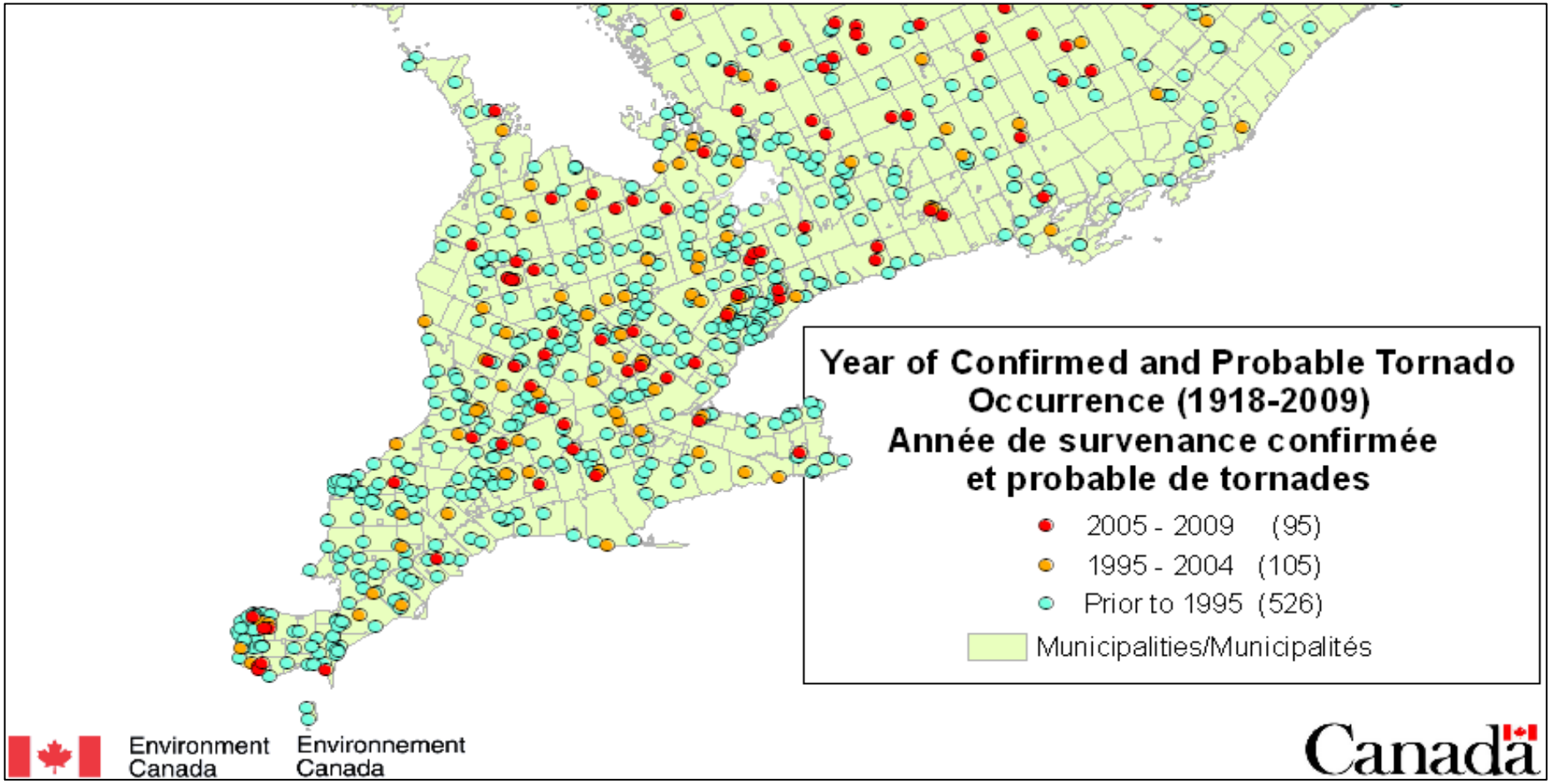
## Historical overview of tornado occurrence in Southwestern Ontario, 1918-2009




Source: Environment Canada (2011).

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# Air Quality in Middlesex London

- Ground level Ozone ($O_3$) is significant health issue for residents in Middlesex-London.
- Nitrogen Oxides (NOx) and volatile organic compounds (VOCs) are two main constituents of ground level $O_3$ in Ontario.
- Significant rise smog advisories until 2007 and then a decrease which may be due to 2008 economic recession and associated decline in industrial activity within Canada and United States.
- Industrial and wild fire transboundary pollution is the highest concern from Ohio, Illinois, Michigan and other states.
- M-L 400 hi-way series, commercial, industrial have an associations with all cause mortality & morbidity issues.

Reported poor air quality days and smog advisories for Middlesex-London, 2003 – 2011

| Year | # of Poor Air Quality Days in M-L | # of Smog Advisories (# of days) in M-L | Average # of Smog Advisories (# of days) for Ontario Municipalities |
|---|---|---|---|
| 2011 | No data | 1 (1) | 5 (9) |
| 2010 | 0 | 2 (9) | 3 (12) |
| 2009 | 2 | 2 (4) | 3 (5) |
| 2008 | 5 | 5 (11) | 8 (17) |
| 2007 | 6 | 12 (27) | 13 (39) |
| 2006 | 4 | 4 (12) | 6 (17) |
| 2005 | 18 | 12 (45) | 15 (53) |
| 2004 | 13 | 6 (16) | 8 (20) |
| 2003 | No data | 5 (14) | 7 (19) |

Source: Ministry of the Environment, 2012a

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# Primary Health Impacts

| Impact | Cause |
|---|---|
| Mortality | Drowning or acute trauma (e.g. debris or building collapse) usually attributable to motor vehicle accidents or inappropriate behavior in flooded areas (e.g. swimming, surfing) |
| Shock, hypothermia | Exposure to floodwater which is often below human core body temperature |
| High blood pressure, heart attacks and strokes | Exertion and stress related to the event |
| Physical injuries such as lacerations, skin irritations, bruises, wound infections | Direct contact with flood water |
| Infection, pulmonary swelling, lung irritation, fungal infection | Aspiration of water into lungs |
| Sprains, strains and orthopedic injuries | Contact with water-borne debris, attempts to escape from collapsed structures, falls from ladders, attempts to rescue people or possessions, etc. |
| Electrical injuries | Contact with downed power cables/lines, circuits and electrical equipment in contact with standing water |
| Burns (fire-related or chemical) and explosion-related injuries | Disturbed propane and natural gas lines, tanks, power lines and chemical storage tanks; toxic gas emissions; rescue boats coming in to contact with power lines |

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# Secondary Health Impacts

| Impact | Causes |
|---|---|
| Exacerbation of existing illnesses, including chronic diseases | Disruption/decreased availability of emergency and ongoing health services, especially if health infrastructure is affected, including: decreased ability to provide/access care; displacement of patients and staff; impaired surveillance of illness, injury, toxic exposure; loss of medical records; loss/impairment of medication and medical devices |
| Carbon monoxide poisoning | Inappropriate use of unventilated cooking tanks (e.g. barbeques), pressure washers and gas powered generators |
| Burns/smoke inhalation | House fires started by candles |
| Dehydration, heat stroke, heart attack, stroke | Exposure of vulnerable populations to environmental stresses in days following event |
| Water- and food-borne diseases – upset stomach/gastrointestinal problems, infectious diseases with longer incubation periods including Hepatitis A, Legionella pneumophila, Norovirus, Rotavirus, Hepatitis A and C | Water and food contamination (e.g. from sewage overflows, flooding of agricultural areas and transport of sediment, fertilizers, pesticides, etc., leakage from tanks holding petroleum products, landfill materials), chemical contamination of water (e.g. from flooding of industrial sites) |
| Respiratory problems/symptoms | Mould and respiratory contaminants from mould, bacteria, fungal growth on damp structures Also, due to Legionaella, Chlamydia, pneumonia, Burkholderia cepacia, and Mycobacterium avium |

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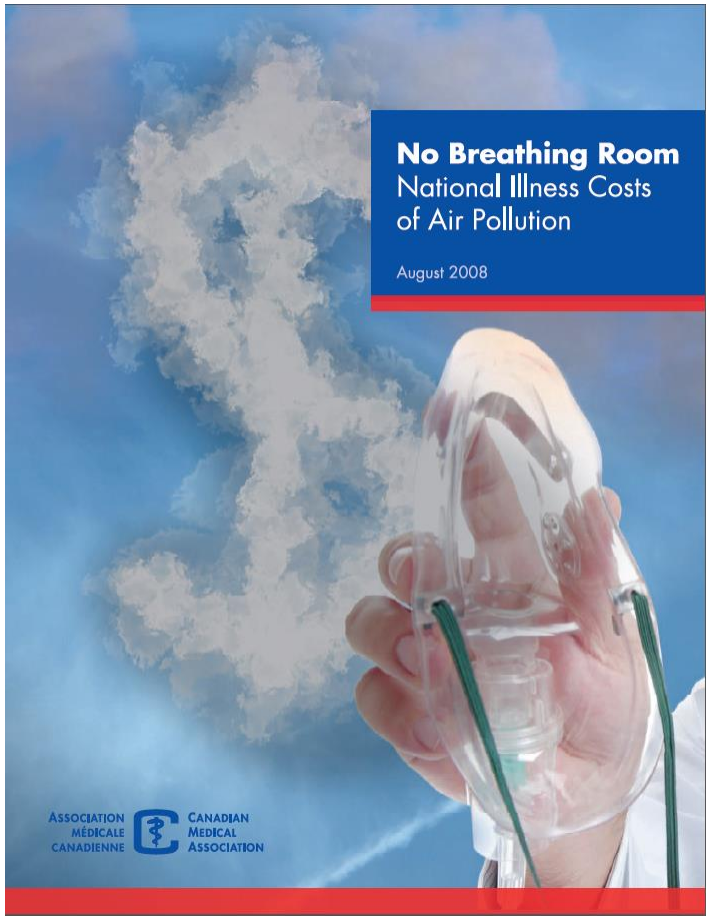
# Canadian Medical Association Air Pollution Costs Projections

- By **2031**, almost **90,000 people** will have died from the **acute effects** of air pollution. The number of deaths due to **long-term exposure** to air pollution will be **710,000.**
- The number of **premature deaths** associated with chronic exposure to air pollution is expected to **rise 83% between 2008 and 2031.**
- Over **92,000 emergency department** visits were associated with air pollution exposure in **2008** increasing to nearly **152,000 by 203**1.
- In **2008**, it was estimated that there were over **620,000 doctor's office** visits because of air pollution. This total is expected to rise to over **940,000 visits in 2031 if air quality does not improve.**
- In **2008**, economic costs of air pollution topped **$8 billion,** by **2031**, these costs could accumulate to over **$250 billion,** if not controlled.

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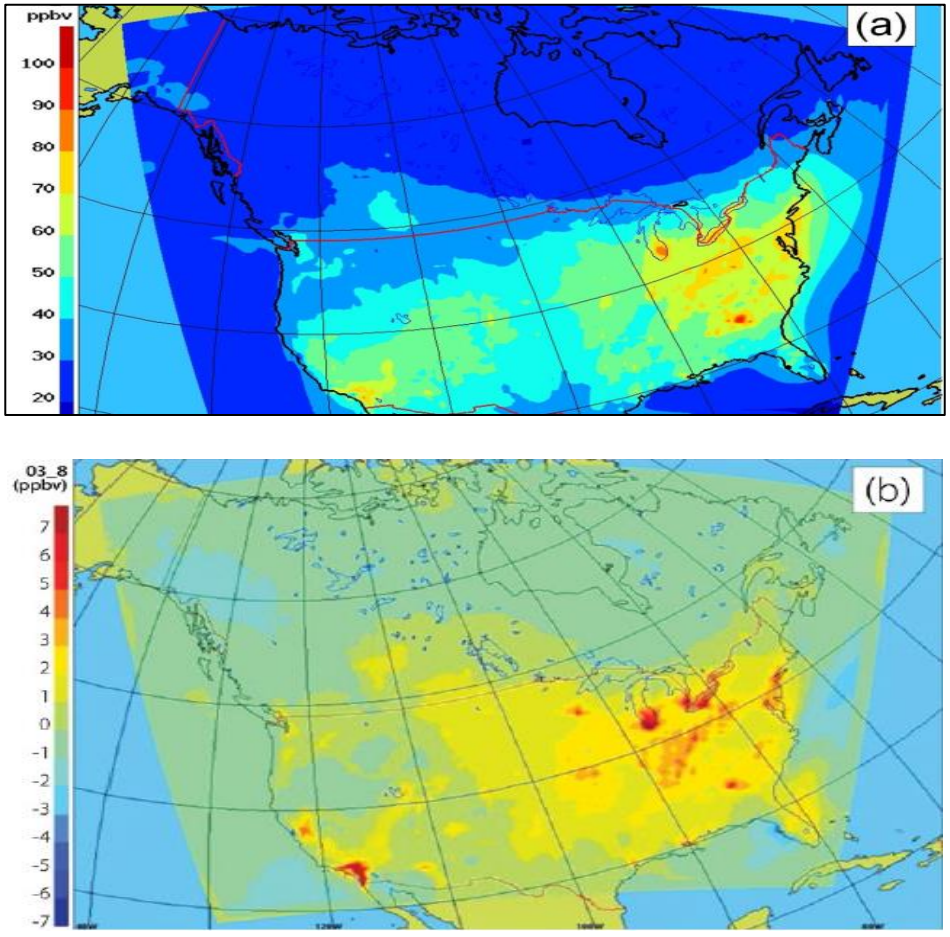
## Projected changes in the summer average daily maximum 8-hour $O_3$ between the "current" case and the "future" case in 2045 with climate change (Kelly et al., 2012)

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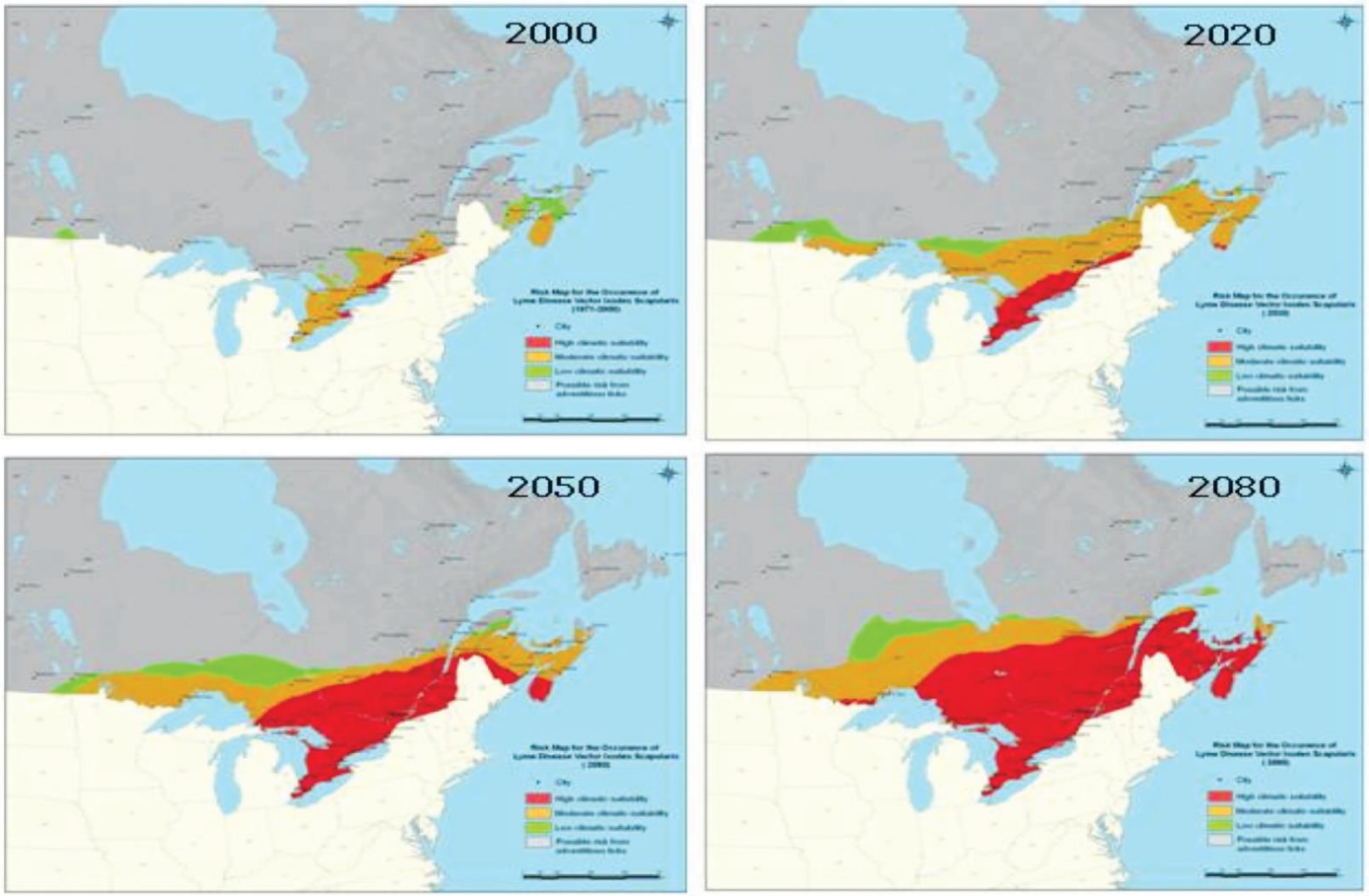
# Vector Borne Diseases

**Risk maps for the establishment and spread of the Lyme disease vector *Ixodes scapularis* under current climate (2000) and projected future climate (2020 to 2080)**




Source: Ogden, 2008

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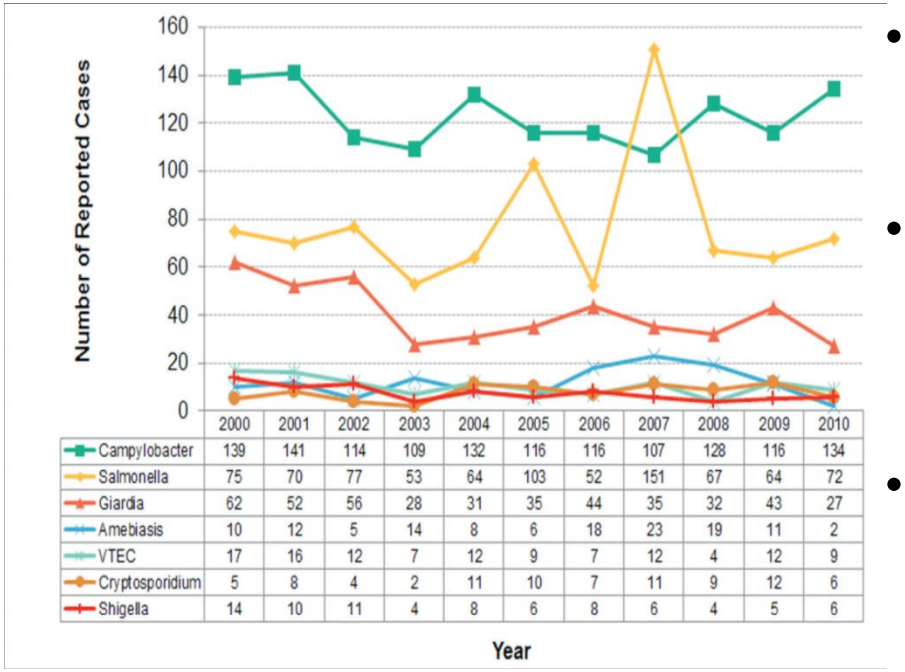
# Water & Food-Borne Illnesses

**The number of reported campylobacter, salmonella, giardia, VTEC and cryptosporidium infections reported in Middlesex-London by month, 2000 to 2010 annual average**




| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Campylobacter | 139 | 141 | 114 | 109 | 132 | 116 | 116 | 107 | 128 | 116 | 134 |
| Salmonella | 75 | 70 | 77 | 53 | 64 | 103 | 52 | 151 | 67 | 64 | 72 |
| Giardia | 62 | 52 | 56 | 28 | 31 | 35 | 44 | 35 | 32 | 43 | 27 |
| Amebiasis | 10 | 12 | 5 | 14 | 8 | 6 | 18 | 23 | 19 | 11 | 2 |
| VTEC | 17 | 16 | 12 | 7 | 12 | 9 | 7 | 12 | 4 | 12 | 9 |
| Cryptosporidium | 5 | 8 | 4 | 2 | 11 | 10 | 7 | 11 | 9 | 12 | 6 |
| Shigella | 14 | 10 | 11 | 4 | 8 | 6 | 8 | 6 | 4 | 5 | 6 |

Source: MLHU, 2014h

- Both Food &Water Borne Illnesses are under reported within Middlesex London area
- With gradual increase in temperatures and frequency of severe weather patterns e.g. precipitation, flooding due to climate change
- Also, aging infrastructure and increasing urban sprawl will further impact the food and water quality due to chemical and biological contaminations.
- Better reporting mechanisms need to be in place to protect the marginalized.

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# Adaptive Capacity

…*Refers to the ability of individuals, communities, and institutions to prepare for and cope with the consequences of climate variability and change.*

- Greater the levels of adaptive capacity….which reduce impacts of higher climate related exposures which then contributes to climate resiliency

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# Stakeholder Workshop March 27, 2014

- **29** Organizations surveyed in Feb 2014 for direct and indirect resilience to climate change.
- **105** stakeholders attended and it was all day long workshop

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# 3 Key Components Identified by Community Stakeholders

1. Socioeconomic Factors
   - High unemployment, limited housing and limited education

2. Adaptation Preparedness
   - Vulnerable population not adequately prepared, no new investment in community capacity & resilience & monitoring to address health risk to CC

3. Community Design and Preparedness
   - Active lifestyle promotion, more trees for shade porous materials for protection against Urban Heat Island Impacts

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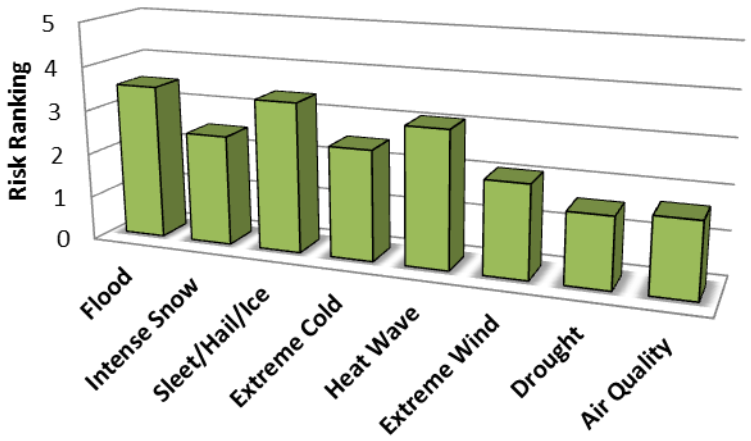
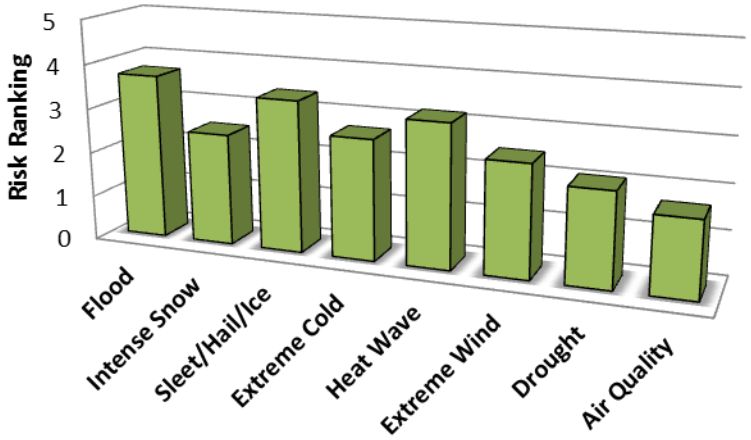
# Risk Assessment Results 2025 & 2050

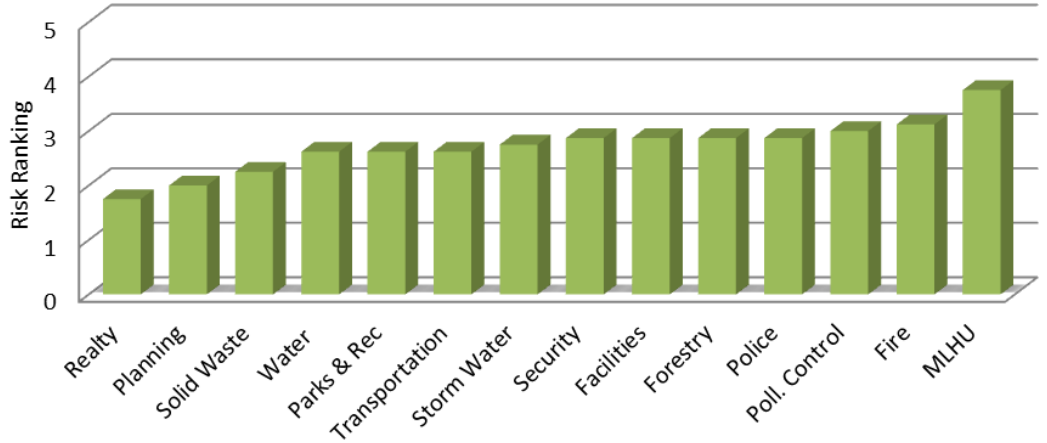
Risk Exposures by Weather Event to 2025




Risk Exposures by Weather Event to 2050




Risk Exposures Ranked by Service Area

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Source: Climate Change Adaptation City of London

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# Vulnerable Groups

- Older adults
- Infants and young children
- Occupational groups
- The physically active
- People who are physically impaired
- People with chronic illness (e.g. heart or lu disease, diabetes, psychiatric illnesses, renal illnesses)
- People on certain medications (e.g. antihypertensive, antidepressants, antipsychotics, anti-Parkinsonian)
- Socially disadvantaged individuals and communities (e.g. low income, homeless, living alone)
- Newcomers to Canada and transient populations

SOURCE: Health Canada

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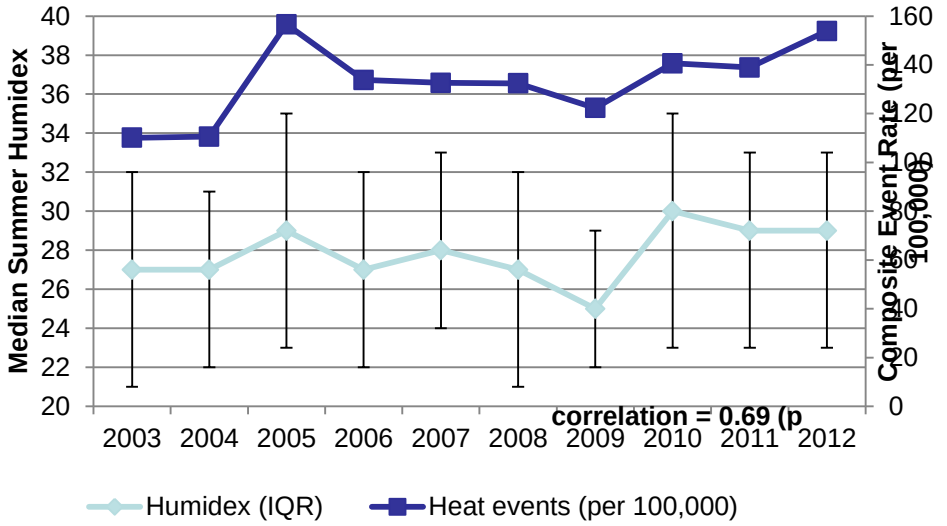
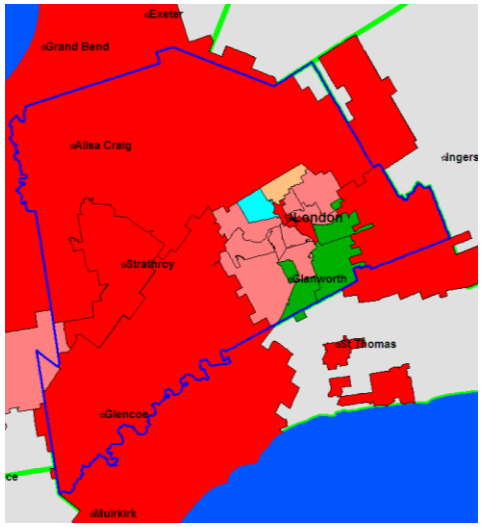
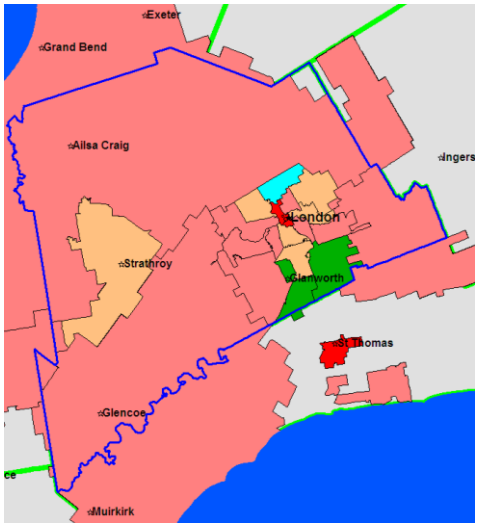
## Median summer Humidex and composite event rate by year




Crude composite event rate by FSA (per 100,000 people): (a) Summer 2005; (b) Summer 2009




Source: MLHU (2014)

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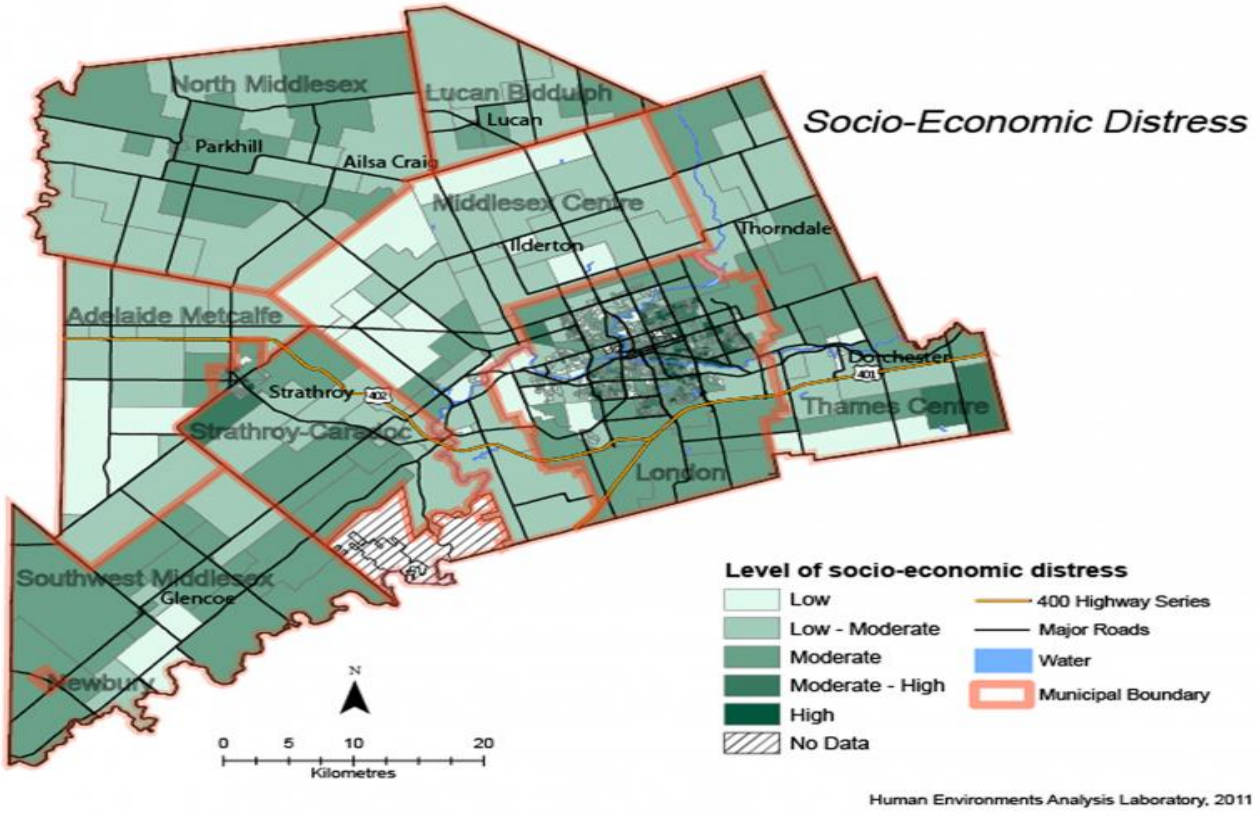
# Socioeconomic distress within Middlesex County




Source: MLHU, 2014e

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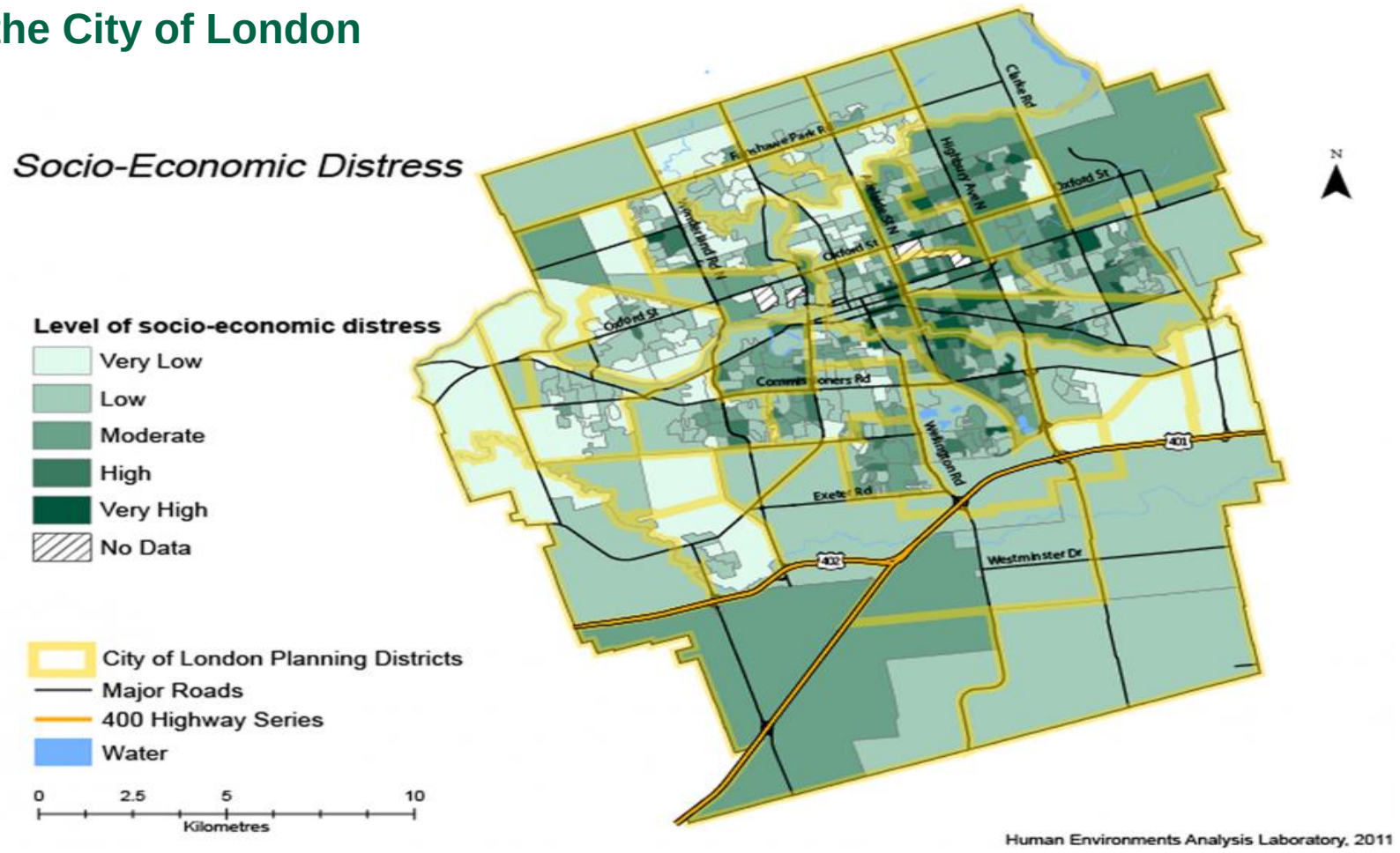
# Socioeconomic distress within the City of London




Source: MLHU, 2014e

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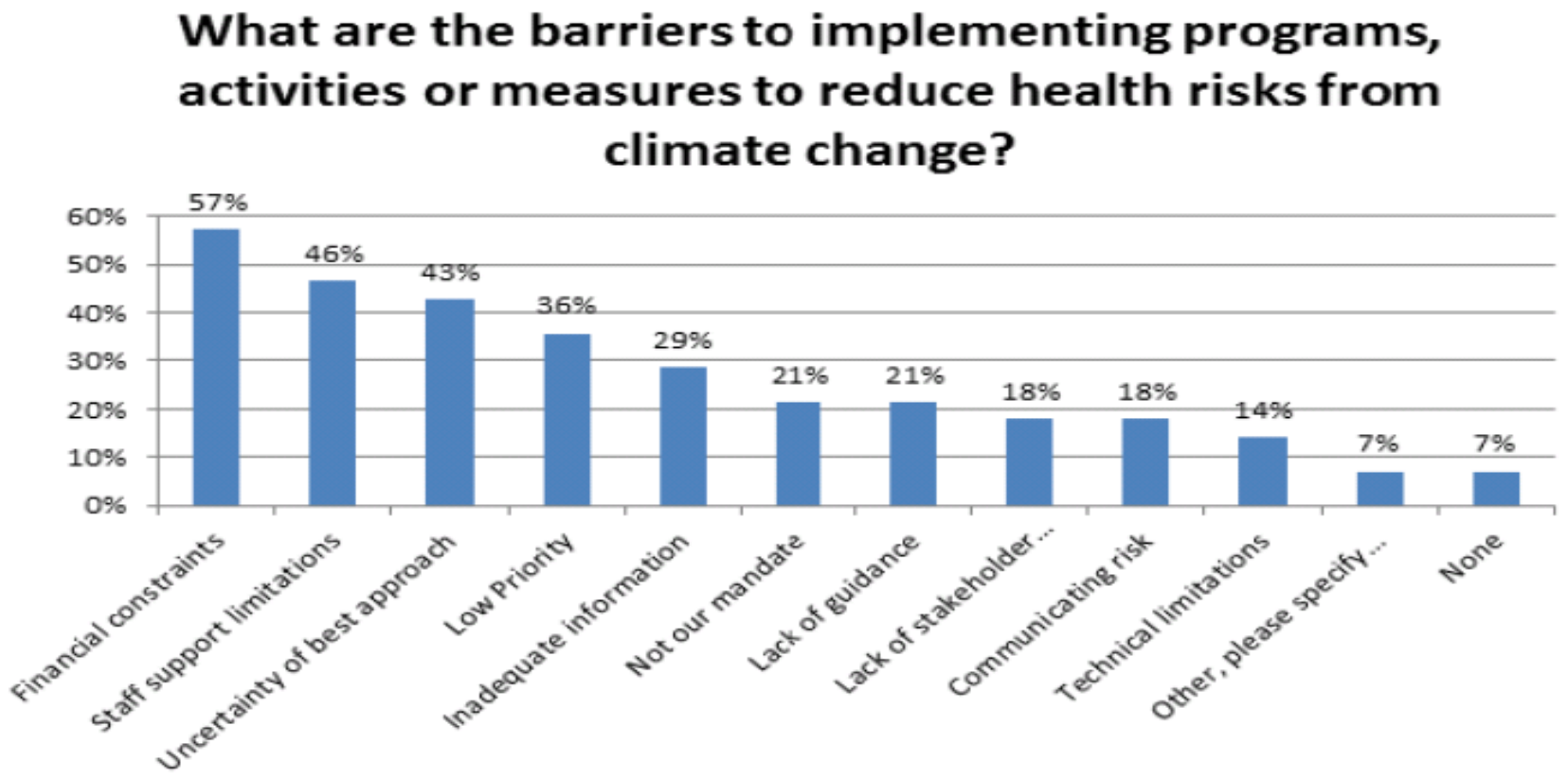
## Barriers to implementing programs, activities or measures to reduce health risks from climate change




Source: MLHU (2014)

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# RECOMMENDATIONS

***Climate Change and Health Action Plan –*** Efforts to address climate change and health risks to residents of Middlesex-London would benefit from the development of an Action Plan to direct future adaptation measures.

***Education and Outreach*** –The results of the report should be disseminated to public health and emergency management officials in the City of London, Middlesex County and the Middlesex-London Health Unit and those with a role in reducing health risks from extreme heat events.

***Evaluating Adaptations –*** Efforts to prepare for climate change health impacts will benefit from evaluations of existing measures to protect people in Middlesex-London from climate-related hazards.

***Surveillance and Monitoring –*** Continued surveillance and monitoring of climate sensitive diseases is needed to better understand and estimate increased health risks that climate change might pose in the region.

***Urban and Rural Vulnerabilities –*** Greater understanding is needed about how climate change and health vulnerabilities may differ between urban and rural populations and communities in the Middlesex-London Region.

***Dealing with Uncertainty*** - Policies and programs that address multiple risks (e.g. planting trees to reduce air pollution, enhancing flood prevention and drought mitigation and reducing the urban heat island) can mitigate the effects of uncertainty and are beneficial as are actions that target both adaptation and greenhouse gas mitigation goals concurrently (e.g., increasing active transportation

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# The Next Steps

We plan to use this baseline knowledge of vulnerability to climate change health impacts to address information gaps, raise awareness of risks among stakeholders, develop iterative evaluation processes to monitor changes in population health and inform development of future public health programs and policies.

We also plans to update information in this report with data from climate models and health outcome projections as they become available. A more formal evaluation of health services in the health region will also assist with better adaptation efforts to protect the most vulnerable and the socioeconomically marginalized populations.

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**According to Dr. Gordon McBean**

**Climate Change Nobel Prize Recipient**

**Local Londoner & Western Professor**

***……Canada must adapt to this new reality of climate change….***

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# Presentations to International Climate Change Forum in Ottawa at Chateau Laurier (April 23, 2014)

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# Acknowledgements


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- ***Middlesex London Health Unit EH Staff***

*Wally Adams, Sarah Maaten, Randy Walker*


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# Questions?

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