

## For Information Only

### Climate Change and the Official Plan

Presented To:	Planning Committee
Presented:	Monday, Feb 25, 2013
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Type:	Managers' Reports

#### Recommendation

For information only.

#### **Background:**

The City of Greater Sudbury is conducting a five-year review of its Official Plan, as required by the *Planning Act*. This Official Plan Review (the review) was initiated in 2012 and encompasses several concurrent study streams including growth and settlement, mobility and lake water quality, to name a few.

On January 23, 2012, the City of Greater Sudbury hosted a Special Meeting under the *Planning Act* to engage the community and hear their views with respect to the matters that should be included in the review. This meeting was well attended and approximately 30 people shared their views with Planning Committee.

Several people spoke to the issue of climate change and the need to build climate change considerations into the framework of the Official Plan to help guide land use and infrastructure decision making. Several others spoke to issues that are interconnected with climate change mitigation and adaptation (e.g. intensification, infill and sustainable mobility).

At that same meeting, Planning Committee directed staff, through Recommendation PL2012-16, to consider any issues or comments related to the Official Plan identified by the public at the meeting.

Since this time, staff has reviewed select international, national, provincial and local research on this issue, examined several municipal planning precedents, and consulted with local experts and stakeholders.

On November 20, 2012, staff also held a workshop with approximately 25 stakeholders drawn from various sectors to explore how the Official Plan can help Greater Sudbury: reduce the risks associated with climate change; strengthen its resilience to climate change; and, capitalize on the opportunities associated with climate change. A summary of this workshop is included in Attachment A.

A key conclusion of this workshop was that while climate change is a new concept in land use planning, many current Official Plan policies are helping Greater Sudbury become more resilient to climate change (e.g. intensification, transit supportive land use policies).

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## **Purpose:**

This report looks at the research on climate change and what it could mean for Greater Sudbury. It describes the connections between climate change and land use planning policy. It highlights existing Official Plan policies that are helping Greater Sudbury prepare for climate change and outlines a series of broad land use planning policy proposals that could strengthen our existing policy framework and resilience.

## **Discussion:**

### What is climate change?

Climate change is a term that is often used to describe the enhanced and accelerated warming of the earth's climate system associated with human activities, namely the burning of fossil fuels and their associated greenhouse gas emissions. These human caused emissions make the blanket of naturally occurring greenhouse gases that surround the planet and regulate its temperature, thicker, trapping heat and making the climate system warmer.

According to the Intergovernmental Panel on Climate Change: warming of the climate system is unequivocal; most of the observed increase in global average temperatures since the mid-20<sup>th</sup> century is very likely due to the observed increase in greenhouse gas emissions associated with human activities; and, there is high agreement and much evidence that with current climate change mitigation policies and related sustainable development practices, global greenhouse gas emissions will continue to grow over the next few decades. This latter statement suggests the need to focus on adaptive, as well as mitigative measures.

The effect of climate change varies depending on scale. According to the United Nations, at a global level, climate change is expected to: result in higher temperatures; adversely affect the hydrological cycle; threaten biodiversity; and, increase risk to human health. In North America, climate change is expected to: affect water quantity and quality; contribute to wildfire and insect outbreaks; and, re-arrange ecosystems as species shift north and to higher elevations.

### What does climate change mean for Greater Sudbury?

Greater Sudbury's climate is changing. According to data published by the Ontario Centre for Climate Impacts and Adaptation Resources (OCCAR), Greater Sudbury's climate has gotten warmer and wetter, with warmer and slightly drier summers and warmer and wetter winters, in the last 50 or so years. For example:

- Between 1956 and 2008, the average annual mean temperature increased 1.5 (°C), the average winter mean temperature increased by 2.4 (°C), and the average summer mean temperature increased by 1 (°C).
- During the same timeframe, total annual precipitation increased by 100 mm, total winter precipitation increased by 38 mm and total summer precipitation declined by 6 mm.

Greater Sudbury's climate will continue to change in the future.

- According to models prepared by Environment Canada and the Canadian Climate Change Scenarios Network (CCCSN) that project future conditions compared to trends observed in 1961-1990, assuming continued moderate greenhouse gas emissions, air temperatures in Greater Sudbury will continue to increase between 2.5 to 3.5 (°C) by 2050. Following historic trends, the increases in winter temperatures are expected to be higher than all other three seasons. For example, winter temperatures are expected to be 3.4 to 3.5 (°C) higher, while temperatures in the spring, summer and fall are all expected to be 2.6 (°C) higher.
- According to a paper authored by Jonathan Gula and Richard Peltier that appeared in the November 2012 issue of the American Meteorological Society, mean precipitation in the area may decrease by approximately 5 percent by 2050-2060, with winter mean precipitation decreasing by 5 to 10 percent and summer mean precipitation increasing by 5 to 10 percent.

Based on the above, Greater Sudbury will be warmer and potentially drier in the future. Winter months will warm faster and see less precipitation. Because they are warmer, the precipitation itself will change with less snow and more rain/freezing rain. Summer months will be warmer and wetter. This change is not expected to be uniform. Instead, it will be variable. It is also expected that we will see more frequent occurrences of extreme weather events.

Future changes in temperature and precipitation, climate variability and extreme weather events, are expected to affect

Greater Sudbury in different ways and in different degrees. A case study of climate change in Greater Sudbury that was led by Laurentian University with many community partners in 2005 to 2007 suggests that climate change could have wide ranging implications. These implications are summarized below.

- Forests and ecosystems: increased risk of drought, forest fires and community impacts; changes in forest habitat and ranges; and, insect outbreaks.
- Health sector: heat stress and extreme weather events affecting vulnerable groups; infectious diseases; and, air quality/smog events.
- Municipal infrastructure: floods and extreme rain events; fire frequency and duration due to droughts making residential areas more vulnerable; increased building maintenance costs; and, more frequent road and culvert repairs.
- Water: lower water levels and decreased water supply; changes in water quality; changes in lake ecosystems; impact on shoreline wetlands and other critical habitats; less hydropower production; and, impacts on recreational activities such as boating and fishing.
- Industry: mining sector operations may be impacted by decreased water supply; forestry sector could be impacted by insect outbreaks; and, agriculture sector could be affected by droughts.

The wide scope of these implications suggests the need for a proactive, comprehensive and coordinated approach to climate change.

#### What is the Greater Sudbury doing to get ready for climate change?

Since 1995, the City and community have pursued a wide range of activities that are helping Greater Sudbury build resilience to climate change. Some key highlights include:

- In 1996, Sudbury joined the Cities for Climate Protection Program;
- In 1998, Sudbury joined the Partners for Climate Protection Program;
- In 2000, the Earthcare Sudbury was created;
- In 2002, the Canadian Climate Impacts and Adaptation Research Network – Ontario (now the Ontario Centre for Climate Impacts and Adaptation Resources) was created in Greater Sudbury;
- In 2002, Earthcare released the Earthcare Sudbury Local Action Plan;
- In 2005-2007, Laurentian University and various community partners undertook a study of climate change in Greater Sudbury;
- In 2007, the City of Greater Sudbury (in partnership with the Sudbury District Health Unit) released a Hot Weather Response Plan;
- In 2008, Greater Sudbury is included in the First National Engineering Vulnerability Assessment Report for Roads and Related Infrastructure;
- In 2008-2009, the Climate Change Consortium is conceived and created;
- In 2010, Earthcare releases a revised Local Action Plan; and,
- In 2011-2012 the City of Greater Sudbury releases an Emergency Response Plan, Community Flood Management Plan and Revised Hot Weather Response Plan that all take climate change into consideration.

While these initiatives are important, they are not the only initiatives that the City and community can pursue to mitigate and adapt to climate change.

#### How does the City, through its Official Plan, fit into the picture?

At a conceptual level, there is scientific consensus that the climate is changing and that human activity (and associated burning of fossil fuels and greenhouse gas emissions) are accelerating the rate of change. There is a connection between the Official Plan and human activity. Land use planning helps shape where and how people live and work, how they move around, and how natural resources are protected. It also helps keep development away from areas that may threaten public health and safety. The Official Plan also guides municipal infrastructure investment, municipal by-laws and other planning tools (e.g. zoning by-law, site plan control, subdivisions and consents). The Official Plan is an important tool that can help Greater Sudbury mitigate and adapt to climate change. The key, given the somewhat uncertain nature with respect to the degree of change that will actually occur, will be to maintain flexibility.

At a provincial level, the sources of greenhouse gas emissions in Ontario provide additional cues as to where land use planning policy might best help. According to the Province, in 2008, Ontario emitted 190.2 Mt of greenhouse gases into the environment. The transportation, industrial, building and electricity sectors were the four largest sources of

emissions, accounting for 90 percent of all emissions. The transportation and building sectors combined account for nearly 50 percent of all emissions. Land use planning can influence these sectors.

Building on the direction outlined in *Climate Ready: Ontario's Adaptation Strategy and Action Plan for 2011-2014*, the Province of Ontario recently provided new climate change based land use planning policy guidance through the proposed *Provincial Policy Statement* (PPS) that was released for review and discussion in 2012. Relevant policy excerpts from the proposed PPS are included in Attachment B.

Generally speaking, the Province is suggesting that municipalities can help mitigate and adapt to climate change by using existing land use planning tools to: effectively managing growth; promote compact and mixed use communities that support active transportation and transit; promote energy efficient design; provide more vegetation; and, protect public health and safety from lands subject to flooding and wildland fire hazards.

The proposed policy changes in the areas of growth management, compact mixed use communities, active transportation and transit are designed to help mitigate against climate change. The province is encouraging more compact mixed use communities that facilitate walking, cycling and transit to help minimize the use of fossil fuels and greenhouse gas emissions. The proposed vegetation and natural hazard policies are more adaptive in nature. The province is encouraging the planting of trees and other vegetation, where feasible, to minimize the urban heat island effect and provide shade canopies, which will assist in a warmer environment. The province is proposing the consideration of climate change when planning around natural hazards to ensure that public health and safety is protected as the temperatures and precipitation patterns change and become more variable and extreme.

In addition to these connections, there are other connections between climate change and land use planning in the areas of water and agriculture that are important locally given our geography.

#### How does the Official Plan currently help us prepare for climate change?

The Official Plan includes policies that are helping Greater Sudbury mitigate and adapt to climate change. Some select key policies that are already building our resilience include:

- Growth management policies that: establish a clear and firm settlement area boundary; direct the majority of growth to settlement areas; establish a series of informal nodes and corridors; encourages intensification and infill in settlement areas; and, encourages mixed uses and higher densities on sites with adequate services (e.g. water, sanitary, parks, libraries, public transit, etc) and in the node and corridor areas.
- Energy efficiency policies that: encourage building and landscape design practices that conserve energy and reduce waste through the use of energy efficient techniques and materials; encourage the siting buildings to maximize passive solar gain and capitalize on natural shade canopies; and, encourage compact/mixed use development and LEED standard design.
- Land reclamation and urban tree canopy policies that: support continued land reclamation activities; require landscape plans as part of subdivision and site plan approval to protect the urban tree canopy; and, require municipal road improvement projects to include the provision of trees, where appropriate.
- Active transportation policies that: call for the maintenance and expansion of the pedestrian and bicycle network; require development proposals to be reviewed to ensure that there is adequate pedestrian access and bicycle facilities, wherever possible; require sidewalks, high quality pedestrian connections to transit, pedestrian connections between neighbourhoods, and pedestrian linkages to major attractors/generators on new and reconstructed roads, where feasible; call for the provision of appropriate bike storage facilities at all city-owned buildings and parks; and, encourage bike parking in all new developments especially adjacent to transit corridors, institutional uses, mixed use areas and employment areas.
- Transit supportive policies that: promote urban design and community development that facilitate transit provision; require development proposals be reviewed to ensure efficient routing and that the majority of development is within walking distance of a transit stop; encourage mixed use and higher densities along arterial roads to encourage transit ridership; and, require public transit to be integrated into the long term planning of future employment areas.
- Hazard land policies that restrict development in areas subject to flood hazards including rivers and small inland lakes, Lake Wanapitae, Lake Panache, and other special areas.
- Water policies that recognize the importance of watershed based planning and are designed to: protect the

quality of drinking water resources; protect sensitive groundwater features; protect the quality of lakes, rivers and streams; and, provide for effective stormwater management.

- Agricultural policies that: identify and protect our best agricultural lands from speculation and incompatible development.

Together these policies effectively manage growth, promote compact and mixed use communities that support active transportation and transit, promote energy efficient design, provide more vegetation and protect public health and safety from lands subject to flooding.

What else can the Official Plan do to help us to further prepare?

Building on this base policy framework, the Official Plan can be strengthened to help further mitigate and adapt to climate change:

1. Build climate change into the vision, principles and context of the Official Plan.
2. Formalize the existing system of nodes and corridors with policies and programs that continue to encourage medium and higher density developments (including mixed use) towards these areas to help minimize the use of the automobile, and facilitate walking, cycling and public transit.
3. Expand the existing energy efficiency policy framework to include residential neighbourhoods, commercial areas and employment areas.
4. Strengthen the existing urban tree canopy policy framework and encourage the use of drought tolerant landscape materials.
5. Introduce transportation demand management policies for major new developments to help minimize automobile use and facilitate, walking, cycling and public transit.
6. Strengthen the existing stormwater management policy framework by encouraging the use of permeable materials and other low impact development techniques.
7. Update existing stormwater management policies to reflect climate change and adjust the boundaries of the flood plain where new information is available.
8. Introduce new policies to guide development in areas that may be at risk of wildland fires.
9. Introduce new program related policies that the city and its partners can undertake in the next five years including: the development of a climate change adaptation strategy; the creation of a green development guide; the creation of a five year municipal drain plan; regular updates to intensity-duration-frequency curves used in water management and best management practices relating to stormwater management; and, completion of the flood hazard mapping, amongst others.

The City and its partners can also implement other program related policies in the Official Plan to build further resilience, including the preparation of subwatershed plans for priority watersheds.

It is currently anticipated that other climate change related recommendations relating to transportation, water and agriculture may come forward through the Transportation Background Study Update, the Lake Water Quality and Food System Planning reports that will be tabled with the Planning Committee in the future.

**Conclusion:**

Climate change is an important consideration for the City of Greater Sudbury's Official Plan. City staff will develop new policies, consistent with the above directions, in the next stage of the review. More detailed policy changes will be brought forward as part of the comprehensive Official Plan Amendment that will be tabled for discussion and consideration later this year.



## Attachment B

### PPS Review – Select Draft Climate Change Related Policies

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1.1.1 Healthy, liveable and safe communities are sustained by:

- a) promoting efficient development and land use patterns which sustain the financial well-being of the Province and municipalities over the long term;
- b) accommodating an appropriate range and mix of residential (including affordable housing), employment (including industrial, commercial and institutional uses), recreation, park and open space uses to meet long-term needs;
- c) avoiding development and land use patterns which may cause environmental or public health and safety concerns;
- d) avoiding development and land use patterns that would prevent the efficient expansion of *settlement areas* in those areas which are adjacent or close to *settlement areas*;
- e) promoting cost-effective development patterns and standards to minimize land consumption and servicing costs;
- f) improving accessibility for persons with disabilities by identifying, preventing and removing land use barriers which restrict their full participation in society;
- g) ensuring that necessary *infrastructure* and *public service facilities* are or will be available to meet current and projected needs; and
- h) promoting development and land use patterns that maintain biodiversity and resilience to climate change.

1.1.3.2 Land use patterns within *settlement areas* shall be based on:

- a) densities and a mix of land uses which:
  - 1. efficiently use land and resources;
  - 2. are appropriate for, and efficiently use, the *infrastructure* and *public service facilities* which are planned or available, and avoid the need for their unjustified and/or uneconomical expansion;
  - 3. minimize negative impacts to air quality and climate change, and promote energy efficiency;
  - 4. support *active transportation*;
  - 5. are *transit-supportive*, where transit is planned, exists or may be developed; and
  - 6. support the efficient movement of goods; and
- b) a range of uses and opportunities for *intensification* and *redevelopment* in accordance with the criteria in policy 1.1.3.3, where this can be accommodated

1.6.1 *Infrastructure* and *public service facilities* shall be provided in a coordinated, efficient and cost effective manner that considers impacts from climate change while accommodating projected needs.

- 1.8.1 Planning authorities shall support energy conservation and efficiency, improved air quality, and climate change mitigation and adaptation through land use and development patterns which:
- a) promote compact form and a structure of nodes and corridors;
  - b) promote the use of *active transportation* and transit in and between residential, employment (including commercial, industrial and institutional uses) and other areas;
  - c) focus major employment, commercial and other travel-intensive land uses on sites which are well served by transit where this exists or is to be developed, or designing these to facilitate the establishment of transit in the future;
  - d) focus freight-intensive land uses to areas well served by major highways, *airports*, *rail facilities* and *marine facilities*;
  - e) improve the mix of employment and housing uses to shorten commute journeys and decrease transportation congestion;
  - f) promote design and orientation which:
    - 1. maximizes energy efficiency and conservation, and considers the mitigating effects of vegetation;
    - 2. maximizes opportunities for the use of renewable energy; and
    - 3. takes into account the impacts of climate change; and
  - g) maintain or increase vegetation within *settlement areas*, where feasible.
- 3.1.3 Planning authorities shall consider the potential impacts of climate change that may increase the risk associated with natural hazards.
- 3.1.8 Development and site alteration may be permitted in hazardous lands associated with high to extreme risk of wildland fire where the risk is mitigated in accordance with provincial wildland fire mitigation standards.



# CLIMATE CHANGE AND THE OFFICIAL PLAN

NOVEMBER 20, 2012

## WORKSHOP SUMMARY



Revisit. Review. Revise.  
Revisitez. Réexaminez. Révissez.

Official Plan Review ★ Révision du Plan officiel





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### Attachments:

A – Climate Change and Sudbury's Official Plan Presentation (Dave Pearson)

B – Climate Change and The Official Plan Presentation (City Staff)



## 1. Background

The City of Greater Sudbury is conducting a five year review of its Official Plan. At the beginning of the review process, a special meeting was held under the *Planning Act* to hear from the public on the changes required to the Official Plan. Several people at this meeting suggested that climate change considerations should be built into the Official Plan.

The Official Plan Review is examining several topics, including the connections between climate change and land use planning. To help answer this question, on November 20, 2012, City Staff hosted a Workshop to explore how the Official Plan can help Greater Sudbury:

- reduce the risks associated with climate change;
- strengthen its resilience to climate change; and,
- capitalize on the opportunities associated with climate change.

## 2. Purpose

This report documents the discussion at the Climate Change and the Official Plan Workshop.

## 3. Meeting Agenda

The meeting was structured as follows:

Time	Item	Individual
1:00 pm	Welcoming Remarks	M. H. Simeoni
1:10 pm	Kick Off Presentation	Dr. D.Pearson/J.Ferrigan
1:40 pm	Group Questions/Discussions	All
1:55 pm	Directions to Break Out Groups	M.H. Simeoni
2:00 pm	Break Out Groups	
	Land use and design	
	Mobility	
	Infrastructure	
	Natural environment	
	Natural hazards	



3:00 pm	Report Back and Discussion	All
4:15 pm	Wrap up and Next Steps	M. H. Simeoni
4:30 pm	Event Close	

## 4. Discussion

### Welcoming Remarks

City staff welcomed participants and explained the purpose of the workshop.

### Kick Off Presentations

David Pearson and Jason Ferrigan delivered the attached presentations.

### Break Out, Report Back and Discussion

After some preliminary questions and answers, participants were invited to join one of four breakout groups to further explore the connections between climate change and land use planning policy. The four land use planning policy themes were:

1. Growth management, planning and design;
2. Mobility;
3. Natural hazards; and,
4. Water.

The break out groups worked for approximately one hour and reported their findings back to the larger audience.

### **Table 1 - Growth Management, Planning and Design:**

- The Official Plan should have policies to guide new compact, mixed use development.
- The Official Plan should include policies to guide the retrofitting of the existing urban fabric.
- Integrating land use and transportation is key.
- The quality of the transportation system and the options it provides affects corporate site selection decisions and employee retention/expansion.
- The existing Official Plan intensification target seems reasonable, recognizing that progress relative to this target will be driven by market demand.
- The City should re-examine this target during the Official Plan Review and ensure that the “right” target is defined in consultation with the development community.
- Intensification could serve to improve emergency response times.



- The Official Plan should continue to encourage energy efficient building design. The City should lead by example in this regard.
- The Official Plan could help raise awareness for energy efficient building materials and techniques.
- All new and rebuilt roads should have an active transportation element to them (i.e. bikes and sidewalks).
- The City could pursue relatively low cost fixes to existing infrastructure to encourage new transportation behavior and improve modal split (e.g. third lane on Ramsey Lake Road).
- The Official Plan could help raise awareness for climate change.
- Landscaping policies should encourage the use of native tree/shrub/plant species.
- The language used in key policy areas should be strengthened.

## **Mobility:**

### *First thoughts:*

- There are more impacts associated with climate change than we thought.
- Some things will be hard to change.
- Pace of change times 10.
- We will need “big” sticks and “tasty” carrots.

### *Issues:*

- Lack of redundancy in road network.
- Is building more roads the only solution?
- Public transportation – make it harder to live away from the transit network.
- “Culture” of not using transit – how do we change this?
- More ice makes it harder to get around – changes in maintenance practices (sidewalks).
- Need to develop a “serious” bike network. Implement via a variety of tools:
  - Municipal funding (tax increase?)
  - Condition of Planning Act approvals.
  - Re-jig the application of the 5% parkland dedication provisions.
  - Boulevards
- Need to redefine what a road is (not just for automobiles).
- Make active transport experiences more pleasant
  - Speed
  - Separate right of ways within the right of way
  - Crossings
  - Complete the Creek.
- Change the culture
  - Easier to take the bus
  - Easier to “actively transport”
- Change the idea of rural and urban - make this choice harder.



- Create more of a connection between fiscal outcomes and personal/city choices.
- Call a spade a spade.
- Economic test as part of decision making.
- Access to public transit should be made easier.
- Light rail – Hanmer to Four Corners as spine.
- Get cars off the road
- Money tied up in current thinking – unlock it.

#### *What we want to say!*

- We need a cultural shift – what we are doing is building for the past
  - standards
  - maintenance
  - design for resilience
- Make it harder to live outside of core(s)
- Make core(s) better places to live
- Redefine transportation to match a broader view/perspective
  - complete streets
  - make buses fun – put wifi on them
- Programming
  - bus passes
  - bixi bikes
- Continue to make Sudbury a place people choose to live in because of its resilience to climate change
- Change strength of Official Plan language – because change is 10 times faster
- Use every piece of data we can

#### *Final thoughts:*

- Pace of change is a concern/opportunity.
- However some good signs.
- Embrace change – ready or not here it comes.
- Move away from being auto-centered.
- “Enough” talk about parking already.
- Mobility is life blood of city and biggest part of the problem.

#### **Table 3 – Natural Hazards:**

- No development in flood prone areas.
- Plan for worst case scenarios.
- When updating flood plain mapping, consider what this may look like in 50 years.
- Be proactive – complete the flood plain mapping.





- Public education/awareness/access to date on flood plain information.
- Better mapping of culverts to address flooding in the municipality.
- Better education/alert/work plan to combat flooding.
- Improve site plan control guidelines to require more permeable surfaces and storm water control.
- The Official Plan should address the appropriate infrastructure for wildfire prone areas.
- Look at wildfire case studies from Greater Sudbury.
- Identify areas that may be at risk to wildfire due to forest cover, etc/assess land use/proximity to emergency services/transportation.
- The design storm should work in tandem with infrastructure being proposed.
- Larger communal sewage and water systems should be under control of the City.
- Need to plan for food shortages resulting from natural hazards/disasters.
- Assessment of Sudbury's risk planning for earthquakes.
- Examine drought related concerns:
  - availability of water in the Valley;
  - loss of water in Ramsey Lake may lead to salinity issues and affect drinking water;
  - recharging of water to Ramsey Lake;
  - fire risk;
  - relief from farmers;
  - methods to conserve increased run-off from rain events for later use in droughts;
  - policies/guidelines for drought-resistant landscaping;
  - food plants in city.
- Higher building to lessen footprint and increase green space.
- Ice storms.
- Examine carrots and sticks for green buildings and tree plantings.
- How do we work with Federal and Provincial governments to help mitigate and adapt to climate change.
- Public-private partnerships to have industry contribute to long term green infrastructure.
- Green energy should be part of the Official Plan.

#### *Final Thoughts:*

- Planned development should not put residents at risk for impacts of climate change.
- City should make mapping resources current and more readily available and interactive.
- Assess the city's risk to wildfire, where are vulnerable areas?
- Promote/incent green infrastructure & buildings



#### **Table 4 - Water:**

- Climate change influences on water should be addressed under General Provisions to cover broad influence – watershed based planning – implementation via watershed studies.

#### *Section 8.6 Stormwater:*

- apply highest standards.
- quantity and quality.
- low impact design.
- integrated, comprehensive stormwater management solutions.
- buffer (for shoreline and riparian wetlands).
- sediment control.
- Identify and prioritize vulnerabilities.
- Are stormwater management guidelines meeting our needs?
- Proponent driven sub-watershed modelling based on base watershed plans (prepared by municipality).
- Watershed plan should be comprehensive to find 'operational' issues.
- Liability in damages following significant storm events, if certain measures have not been adopted.

#### *Water Recharge:*

- Keep significant water recharge areas vegetated.
- Map the significant ground water features.
- Conservation elements during development design.
- Water conservation programs.

#### *Surface Water Features:*

- Policies to protect private drinking water sources on lakes.

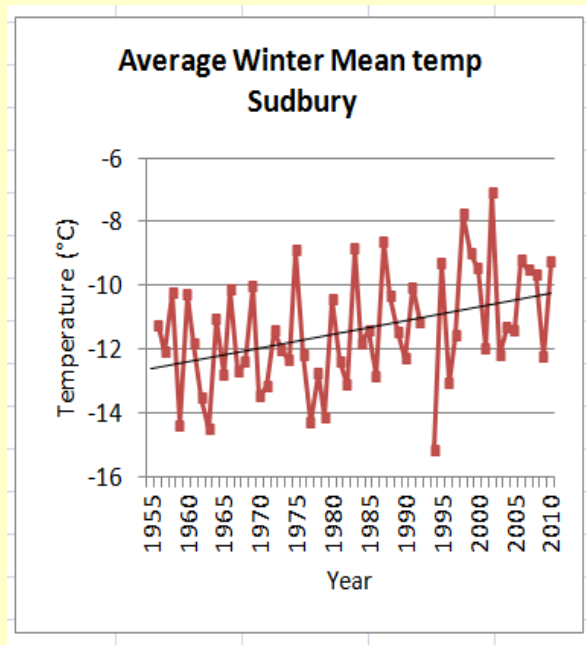
#### *Development:*

- On-site water retention policies.
- Organic matter additions on some sites.
- Use re-greening strategically.
- Watershed targets for pervious and/or impervious cover.
- Monitoring for adaptive management.
- Hutchinson Environmental Report.





# Climate Change and Sudbury's Official Plan



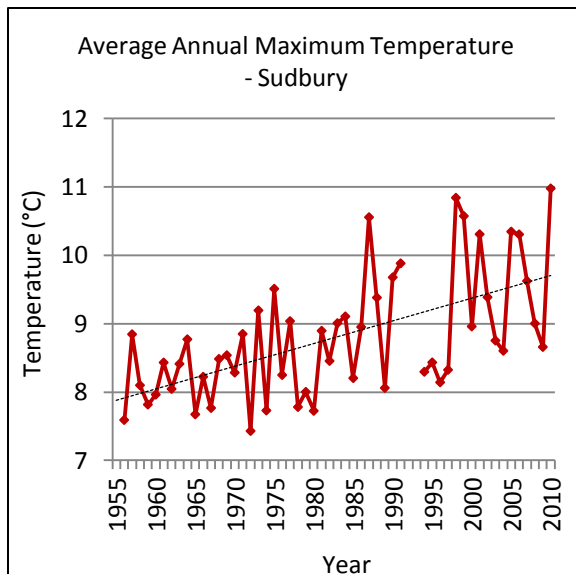
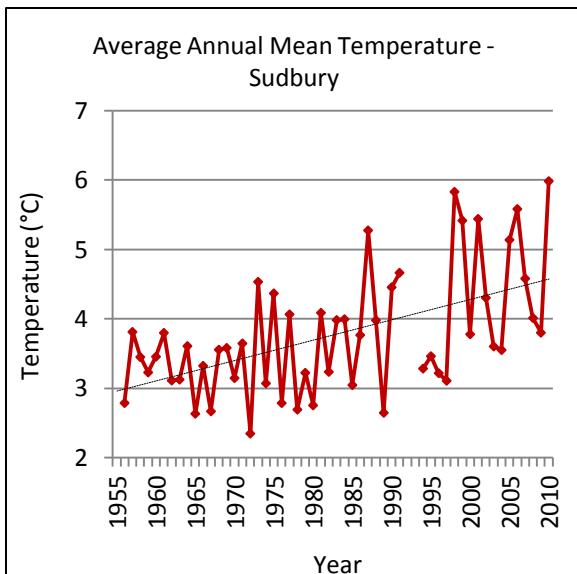
David Pearson  
Laurentian University

20 November 2012

# Annual Temperature and Precipitation since 1955

**Average  
annual  
mean temp**

**Increase  
1.6°C**

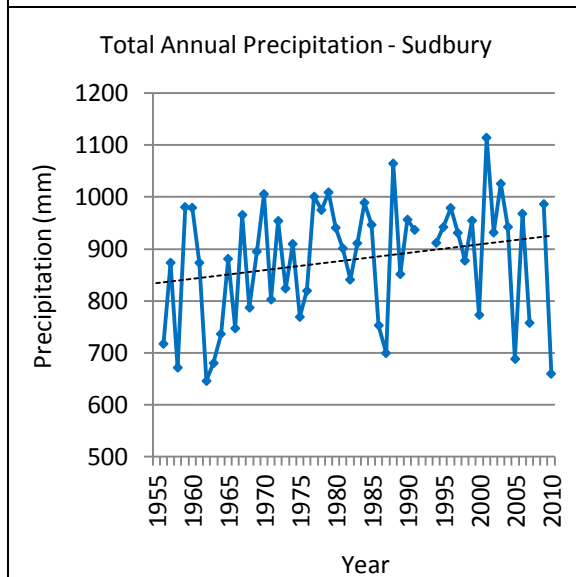
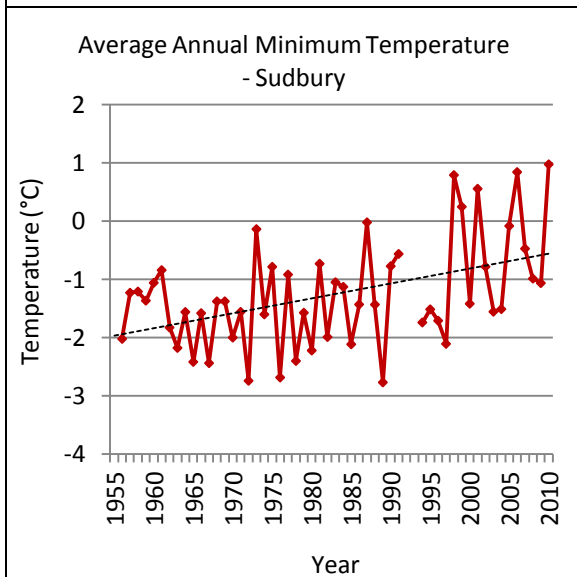


**Average  
annual  
max temp**

**Increase  
1.8°C**

**Average  
annual min  
temp**

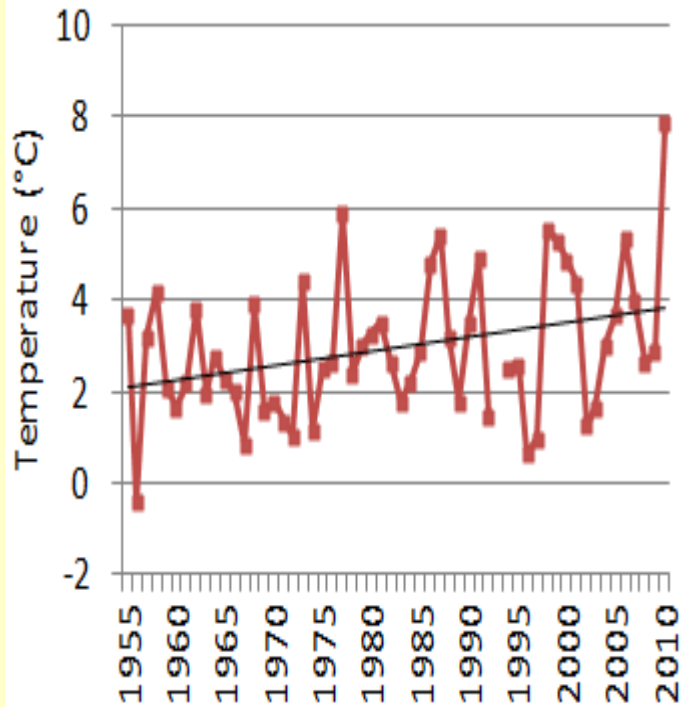
**Increase  
1.4°C**



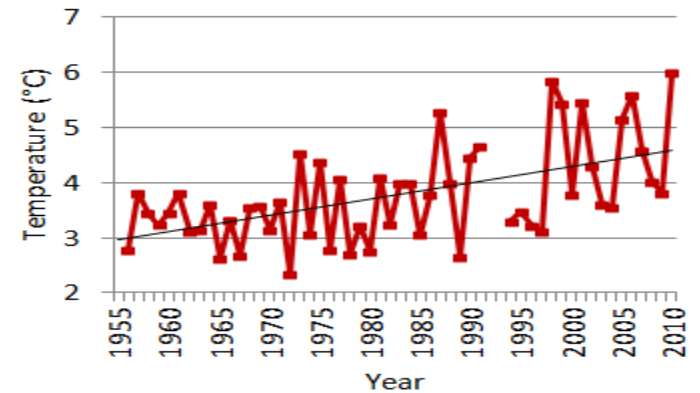
**Total  
annual  
precip**

**Increase  
92mm  
(10%)**

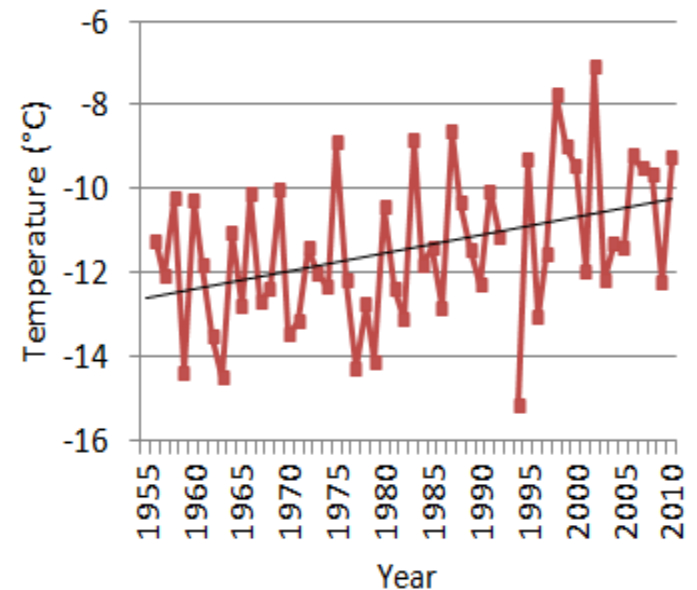
**Average Spring Mean Temp  
Sudbury**



**Average Annual Mean Temp  
Sudbury**



**Average Winter Mean temp  
Sudbury**

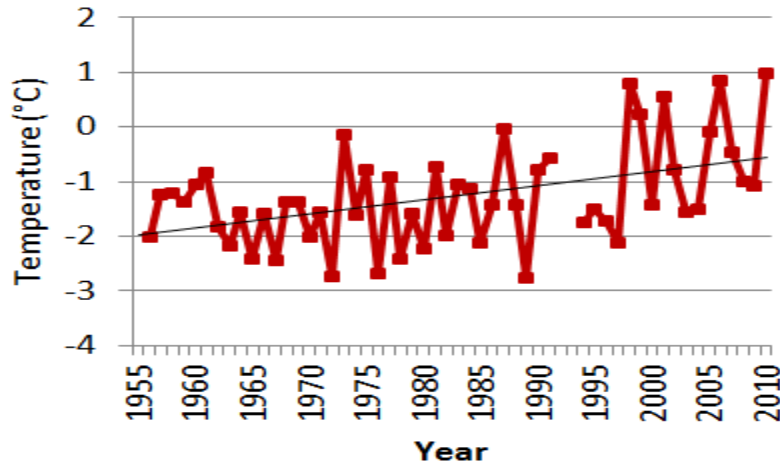


1.6°C rise in av. Annual mean temp

1.9°C rise in av. Spring mean temp

2.4°C rise in av. Winter mean temp

**Average Annual MinTemp  
Sudbury**

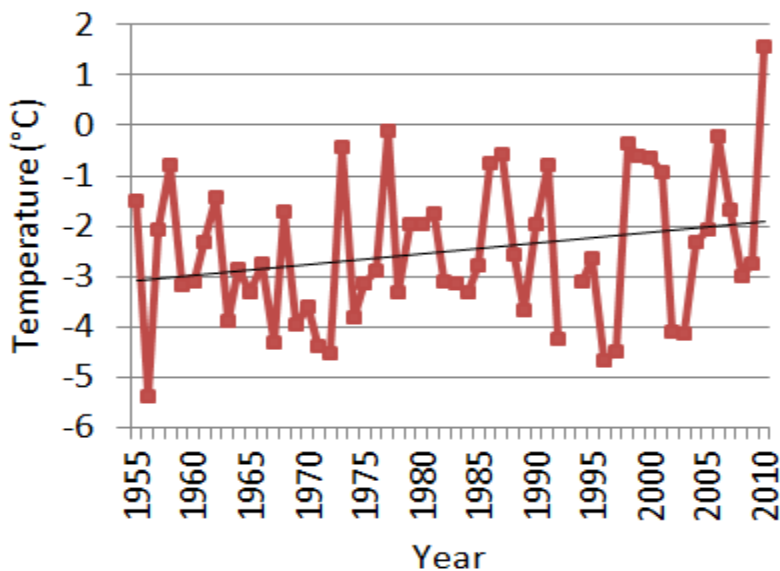


1.4°C rise in av. Annual min temp

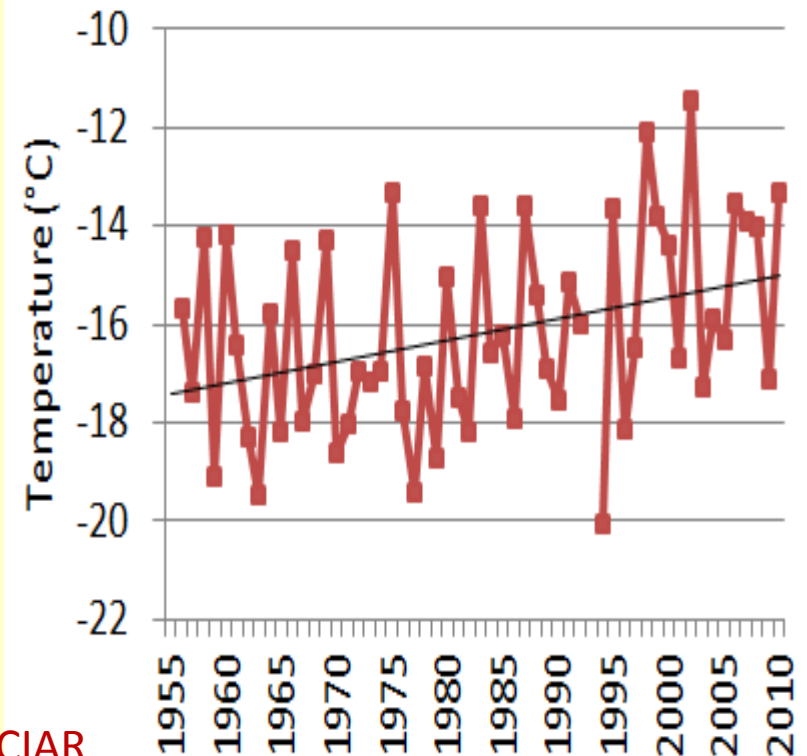
1°C rise in av. Spring min temp

2.4°C rise in av. Winter min temp

**Average Spring Min Temp  
Sudbury**

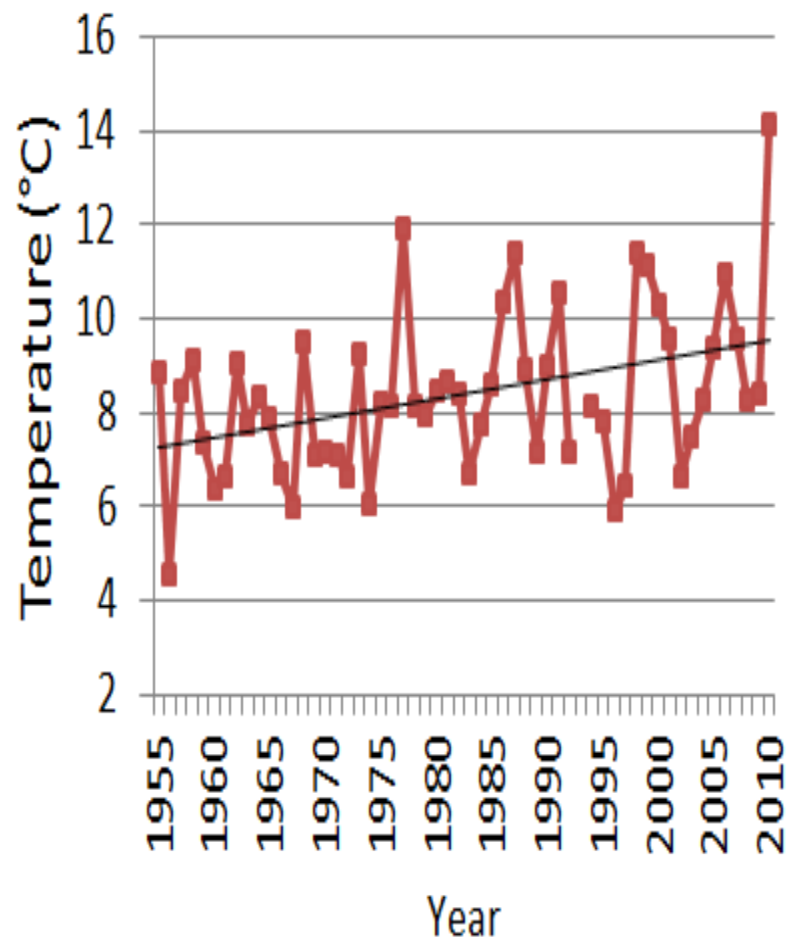


**Average Winter MinTemp  
Sudbury**



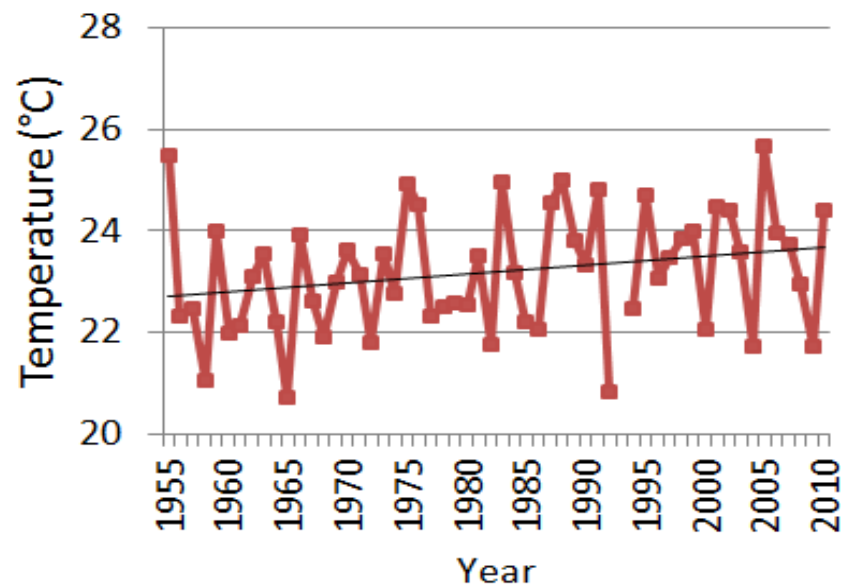
OCCAR

## Average Spring Max Temp Sudbury



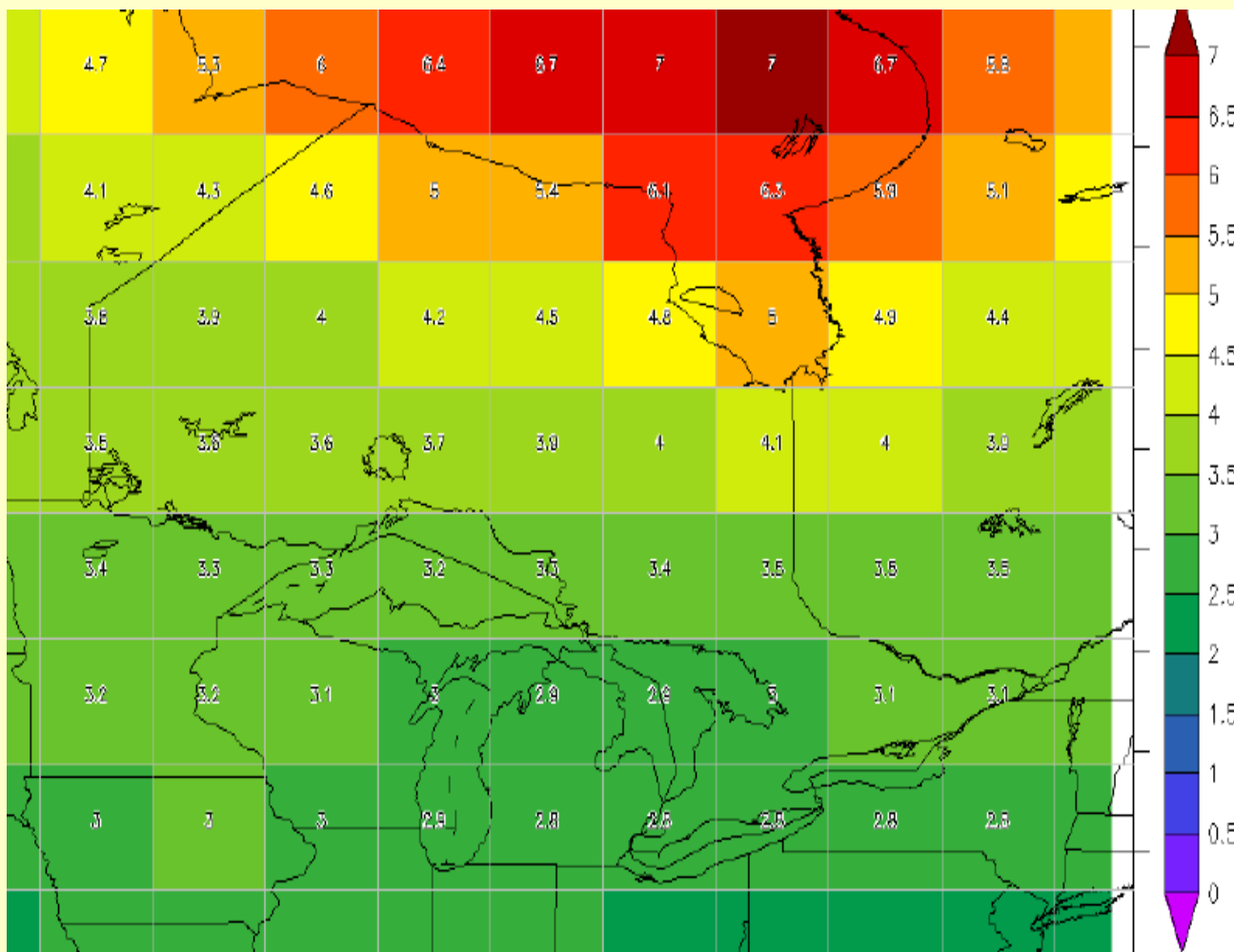
- Average Spring max temp has risen by 2.4 °C ... Days are warmer
- Average Summer max temp has risen by 1°C .... same in the Fall

## Average Summer Max Temp Sudbury

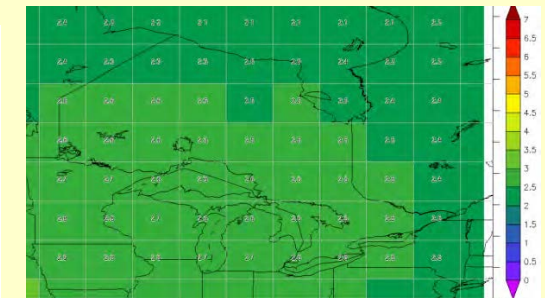




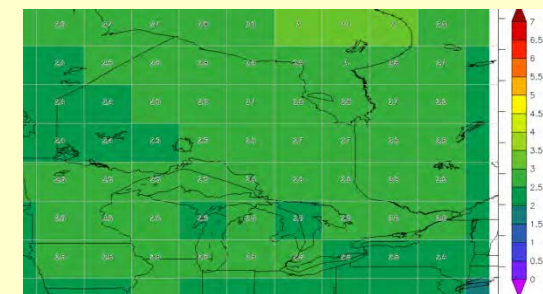
Projected change in average seasonal air **temperature** ( $^{\circ}\text{C}$ ) over Ontario for 2050s compared with 1961 – 1990 under MODERATE GHG emissions (average of A1B and B2 emission scenarios using ensemble of 24 GCMs) CCCSN / Environment Canada. Courtesy Neil Comer



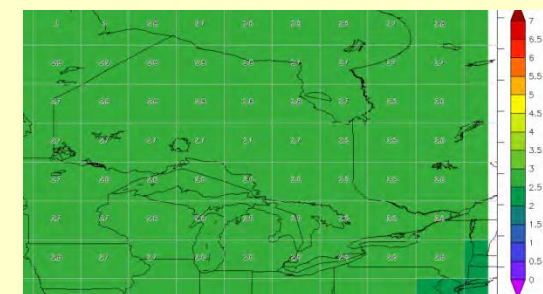
**Winter**



**Summer**



**Spring**



**Fall**

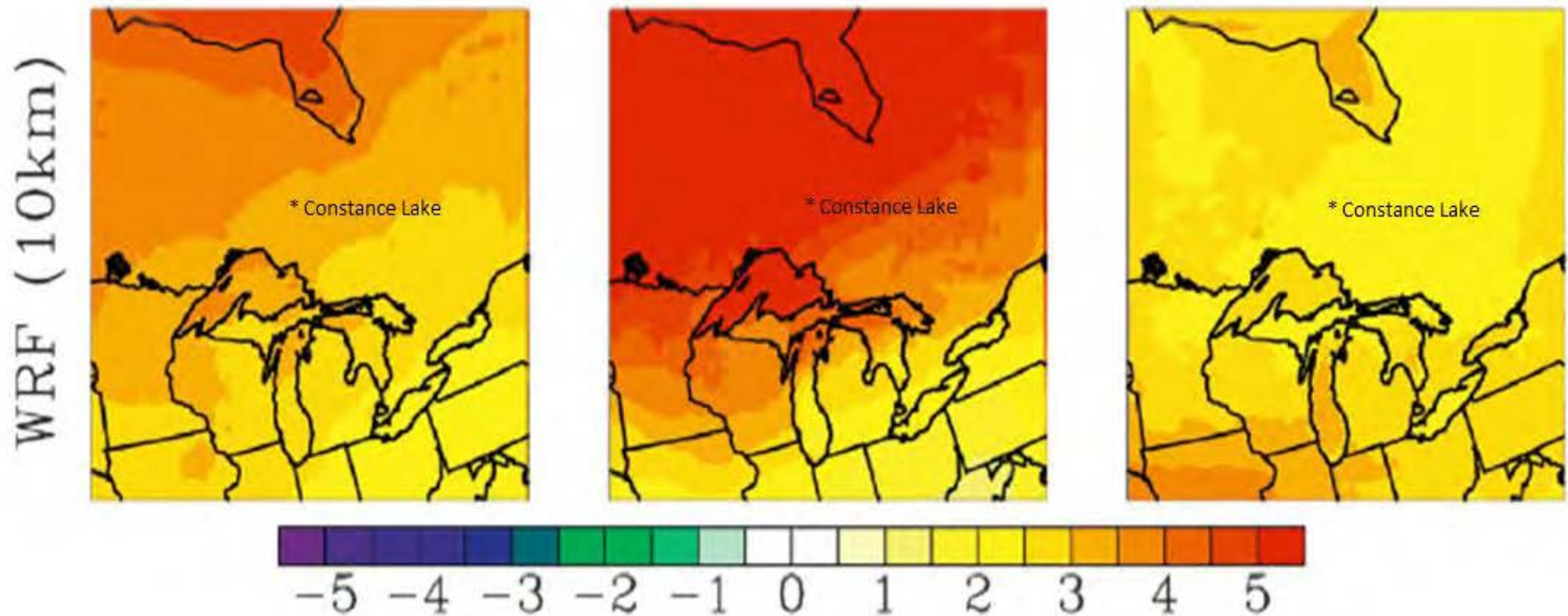
(Environment Canada CCCSN 2009)

# Projected change in mean temp for 2050s cf 1970-2001

Annual

Dec Jan Feb

June July Aug



Downscaled from NCAR CCSM 3 A2 emissions with Weather Research and Forecasting model

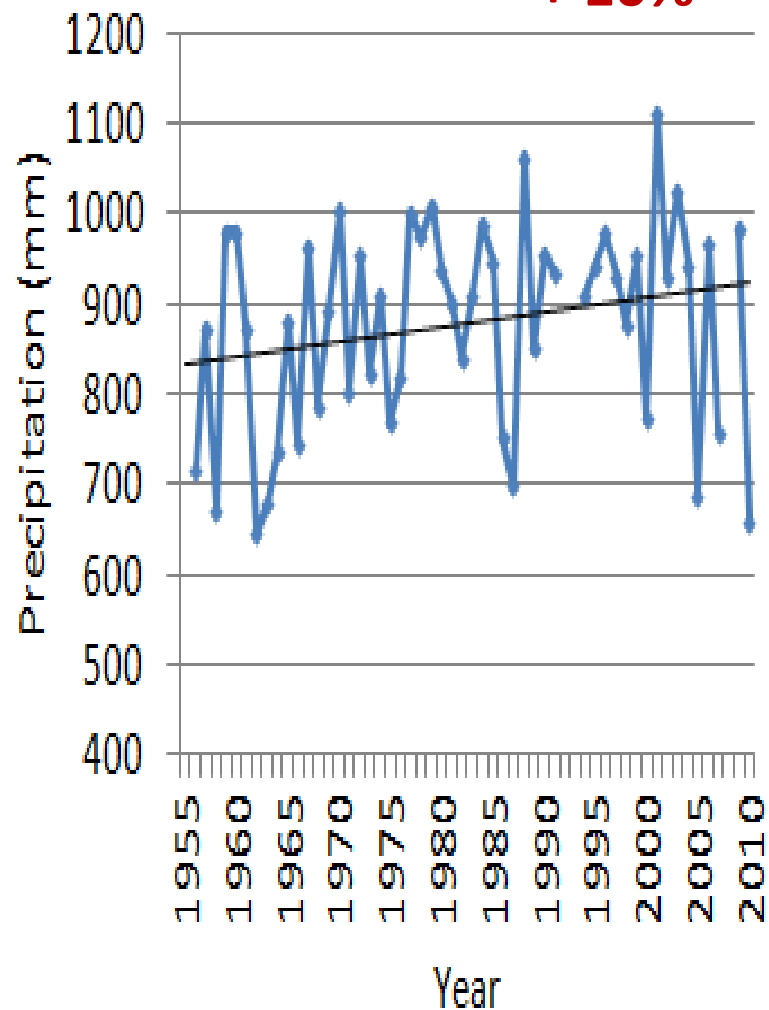
Gula and Peltier Jnl of Climate, Nov 2012



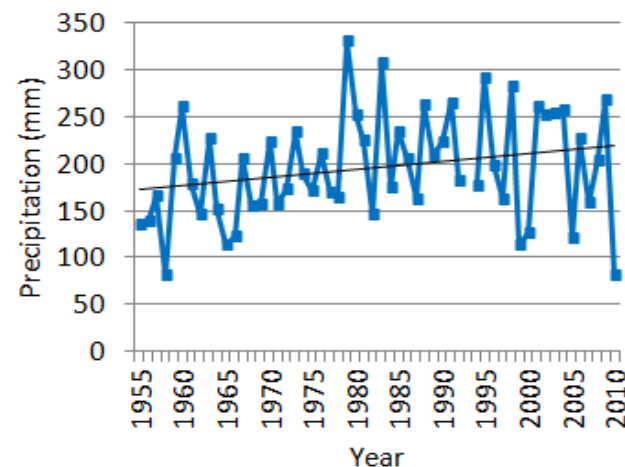
## Total Annual Precipitation -

Sudbury

**Total  
+ 10%**

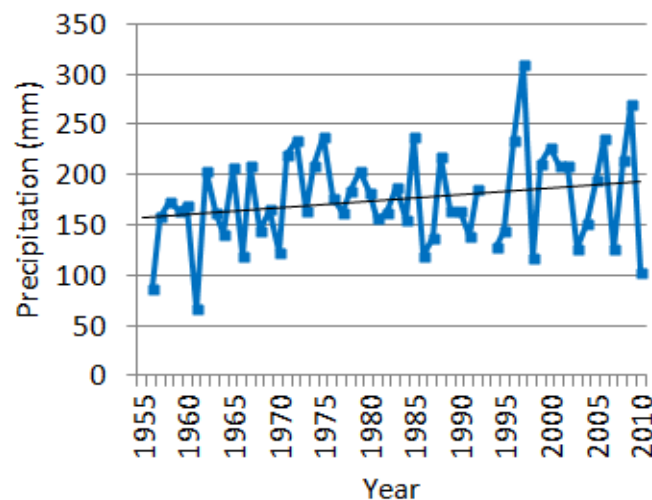


## Total Spring Precipitation Sudbury



**Spring  
+ 25%**

## Total Winter Precipitation Sudbury



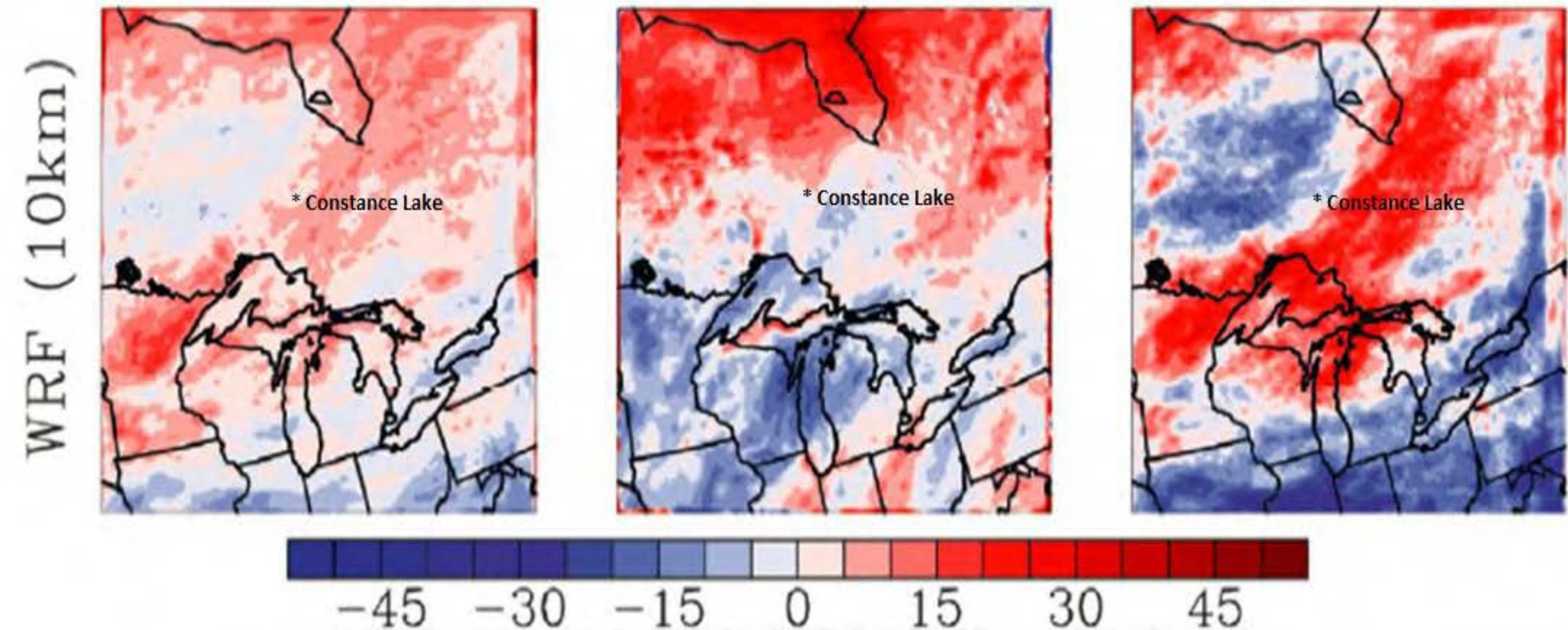
**Winter  
+ 25%**

# Projected change in mean pptn for 2050s cf 1970-2001

**Annual**

**Dec Jan Feb**

**June July Aug**



Gula and Peltier, Jnl Climate, Nov 2012

Downscaled from NCAR CCSM 3 A2 emissions with  
Weather Research and Forecasting model

Annual D-N 2000-2011

L-OTI(°C) Anomaly vs 1900-1910

.80

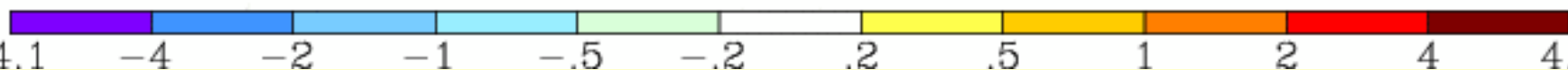
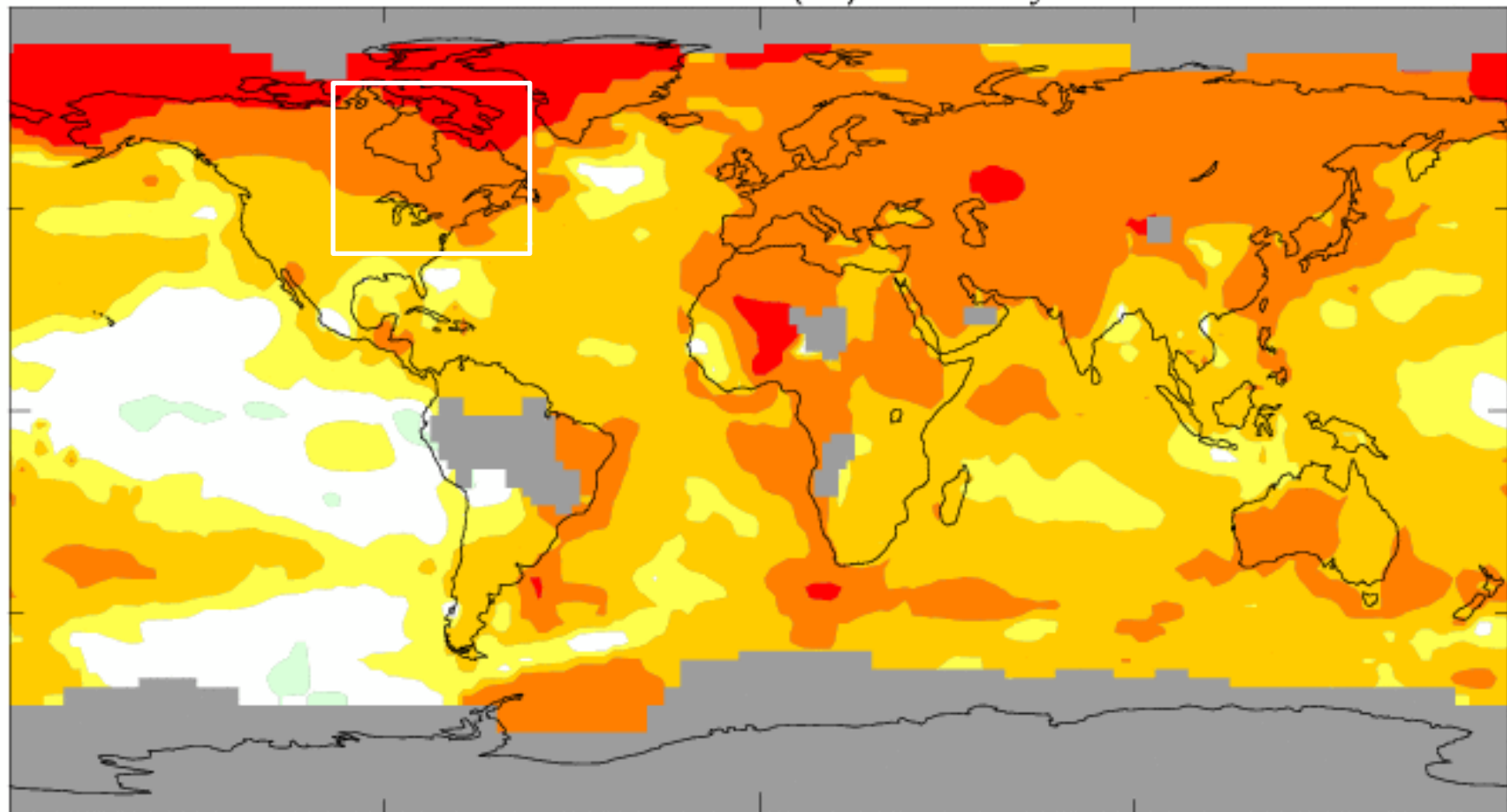


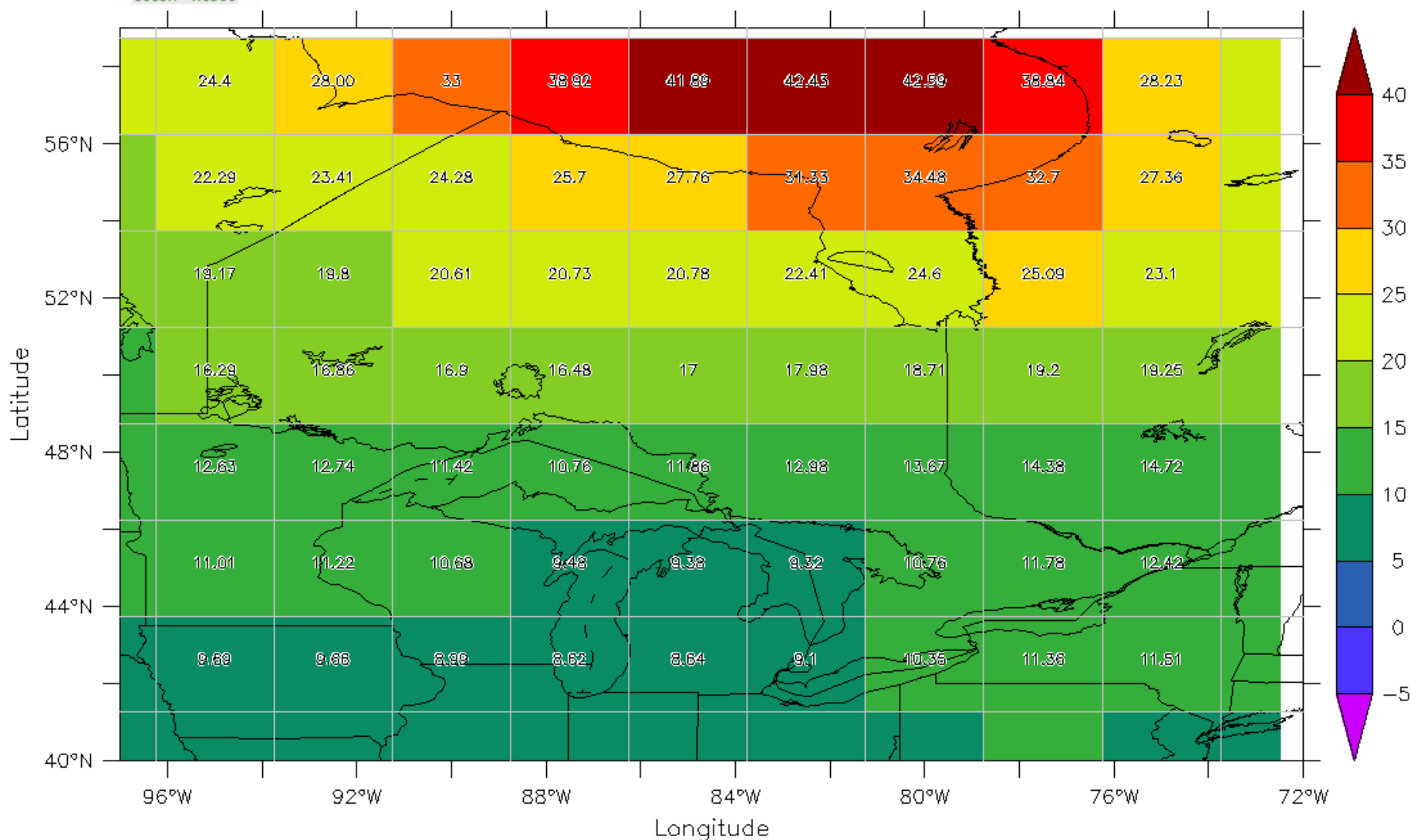
Figure 3: Surface temperature change (°C) from 1900-1910 to 2000-2011, from [NASA GISS](#).



## Common Grid - Composite of Models

Mean change from (1961-1990) to (2041-2070 or '2050s')

Winter - High - Change in Precipitation (%)



(Environment Canada CCCSN 2009)





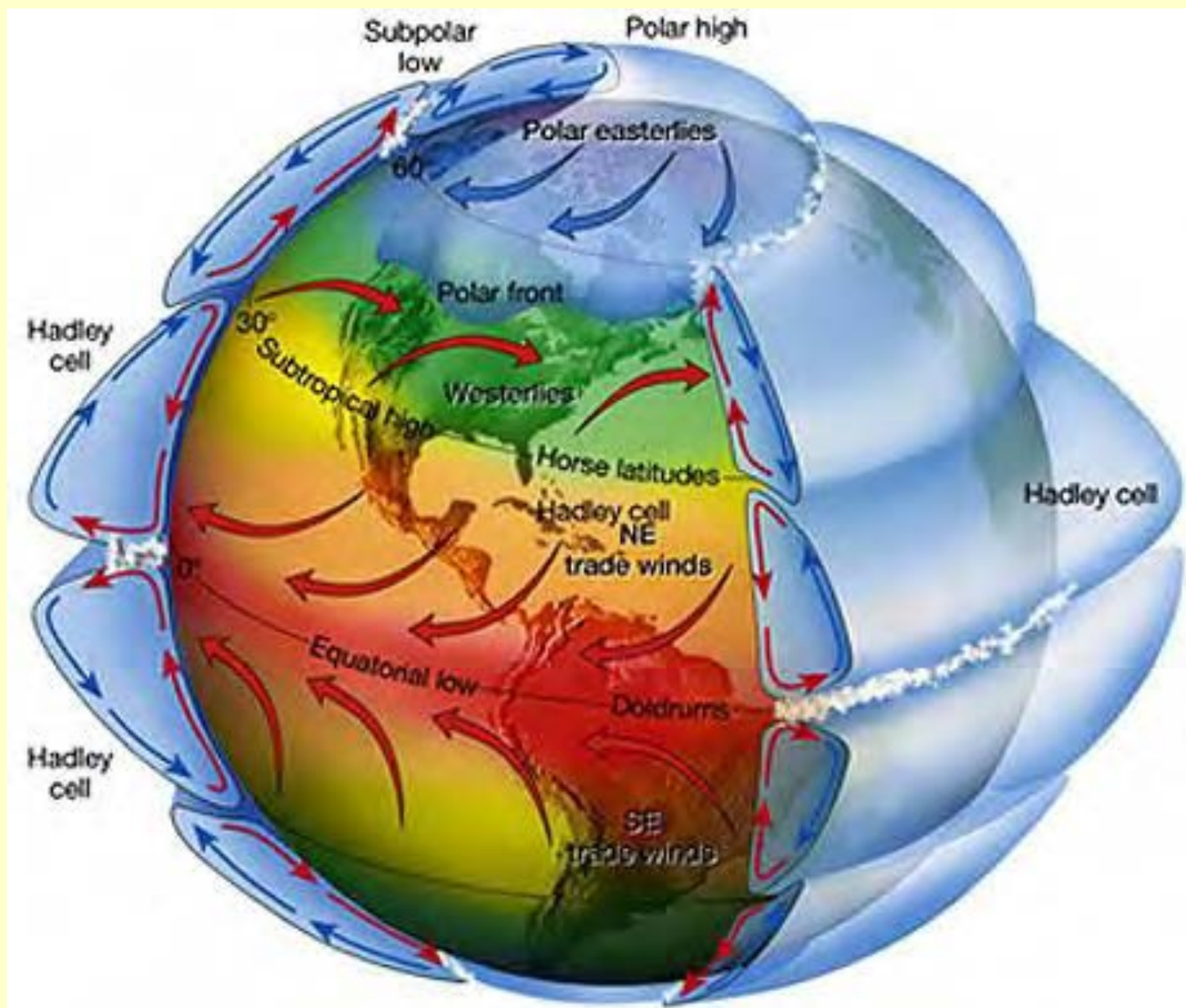
14 Nov 2005





29 April 2006

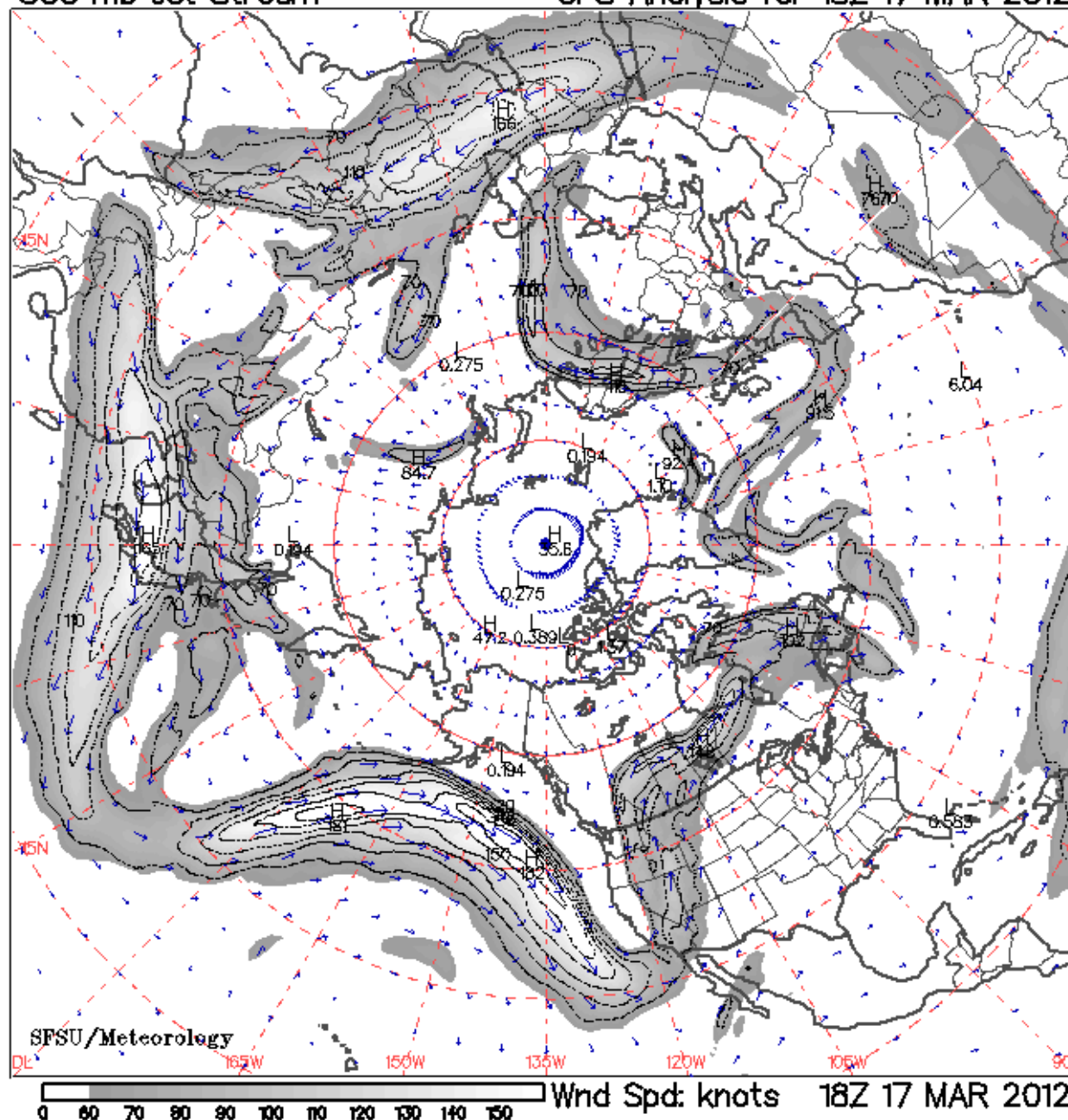
NASA/Goddard Space Flight Center Scientific Visualization Studio





300 mb Jet Stream

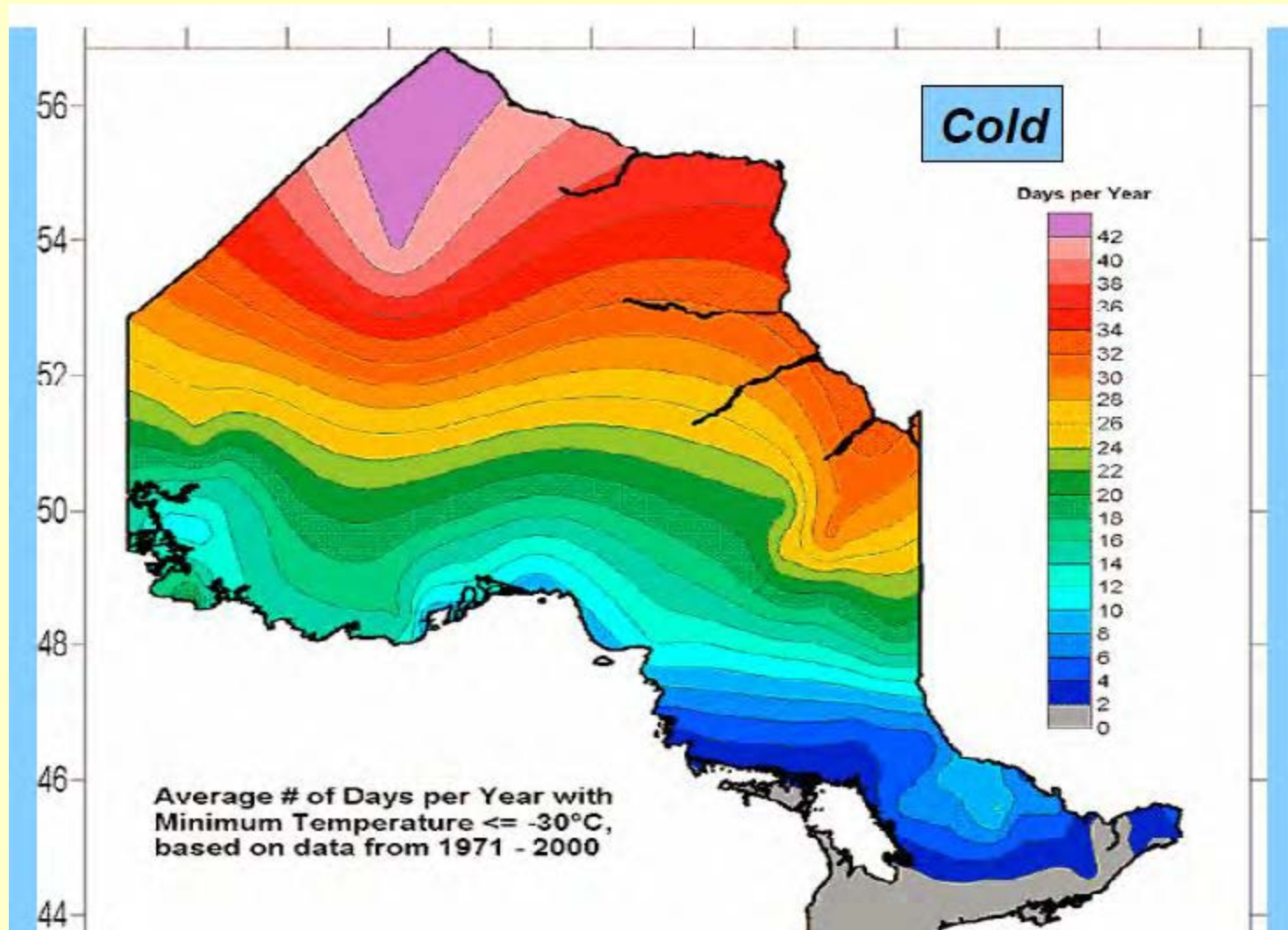
GFS Analysis for 18Z 17 MAR 2012



[http://squall.sfsu.edu/gif/jetstream\\_norhem\\_00.gif](http://squall.sfsu.edu/gif/jetstream_norhem_00.gif)



# Pattern of days $< -30^{\circ}\text{C}$

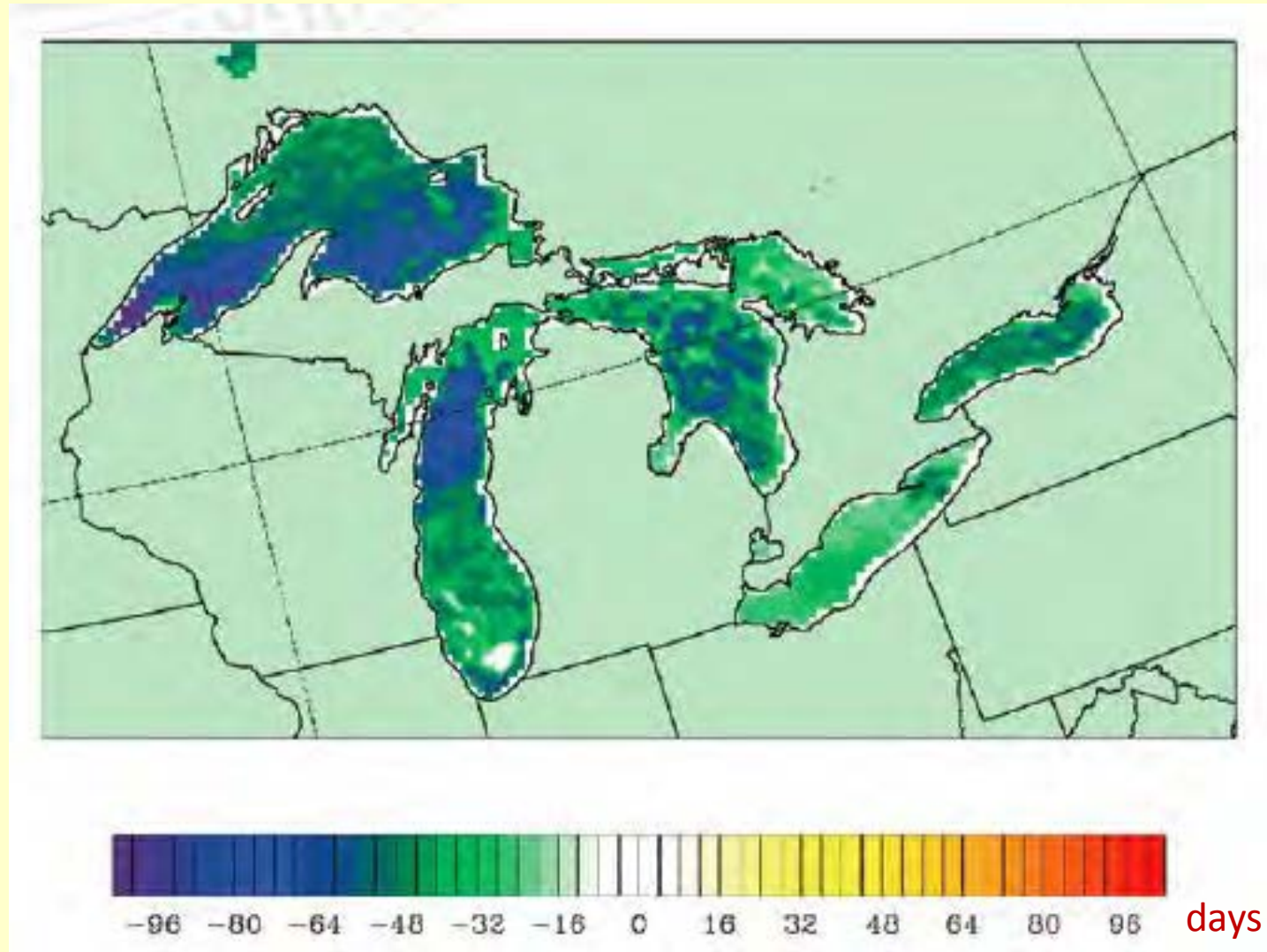


## *Extreme Cold for Greater Sudbury Area*

Location	Station Period of Record (Years)	Extreme Minimum (°C) and Date Recorded (Period of Record)	Extreme Minimum (°C) and Date Recorded (1971-2000)	Extreme Minimum (°C) and Date Recorded (1990-Sep 2002)
Sudbury Area*	1954 – 2003	<b>-39.3 °C</b> Jan 10, 1982	-39.3 °C Jan 10, 1982	-38.0 °C Jan 15, 1994
Coniston Area*	1921 – Oct 2002	<b>-48.3 °C</b> Dec 29, 1933	-44.0 °C Feb 3, 1996 Jan 18, 1997	-44.0 °C Feb 3, 1996 Jan 18, 1997

\*Note: Sudbury Area data represents combined data from Sudbury and Sudbury A. Coniston Area data represents combined data from Coniston and Coniston STP.

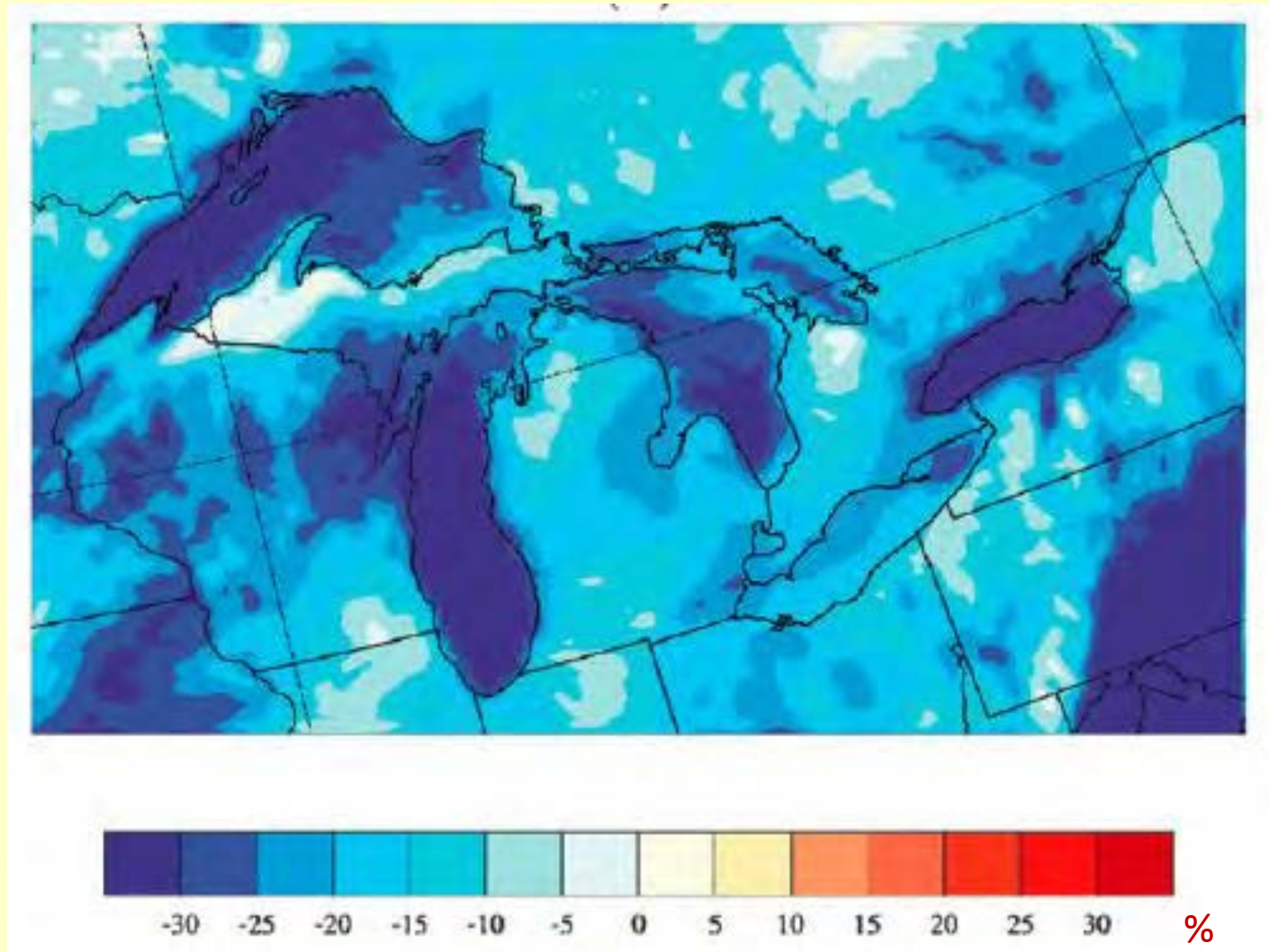
# Projected change in ice cover days for 2050s



Flake model

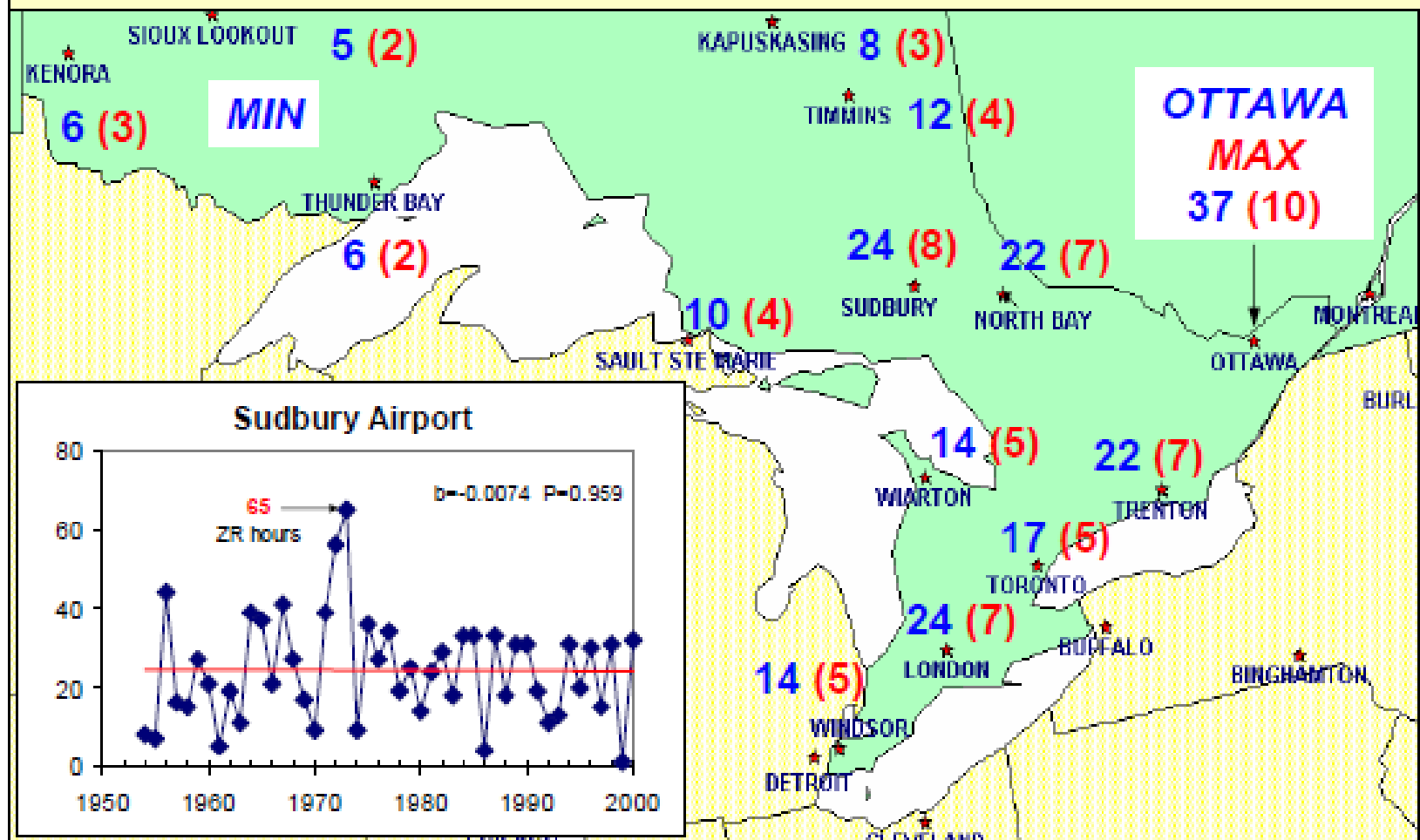
Gula and Peltier J Cl Nov 2012

# Projected change (%) in snowfall for 2050s compared with 1970 – 2001 (WRF)





# Total Annual Freezing Rain Hours (*Days*) for Ontario Stations (1953-2001)



# Extreme rain events

## *Extreme Short Duration Rainfall Statistics for Sudbury A*

Return Period Rainfall Amounts (mm) 1971-2002						
Return Period (Years)	10 min	30 min	1 hour	6 hours	12 hours	24 hours
2	10.6	17.2	21.3	36.4	44.1	50.2
5	14.5	24.1	29.6	47.5	56.9	65.8
10	17.2	28.7	35.0	54.8	65.5	76.1
25	20.5	34.5	41.9	64.1	76.2	89.2
100	25.4	43.1	52.1	77.8	92.1	108.5

Joan Klassen EC 2006

Peterborough storm 2004: 149 mm rain in 2 hours ; 248 mm in 24 hrs

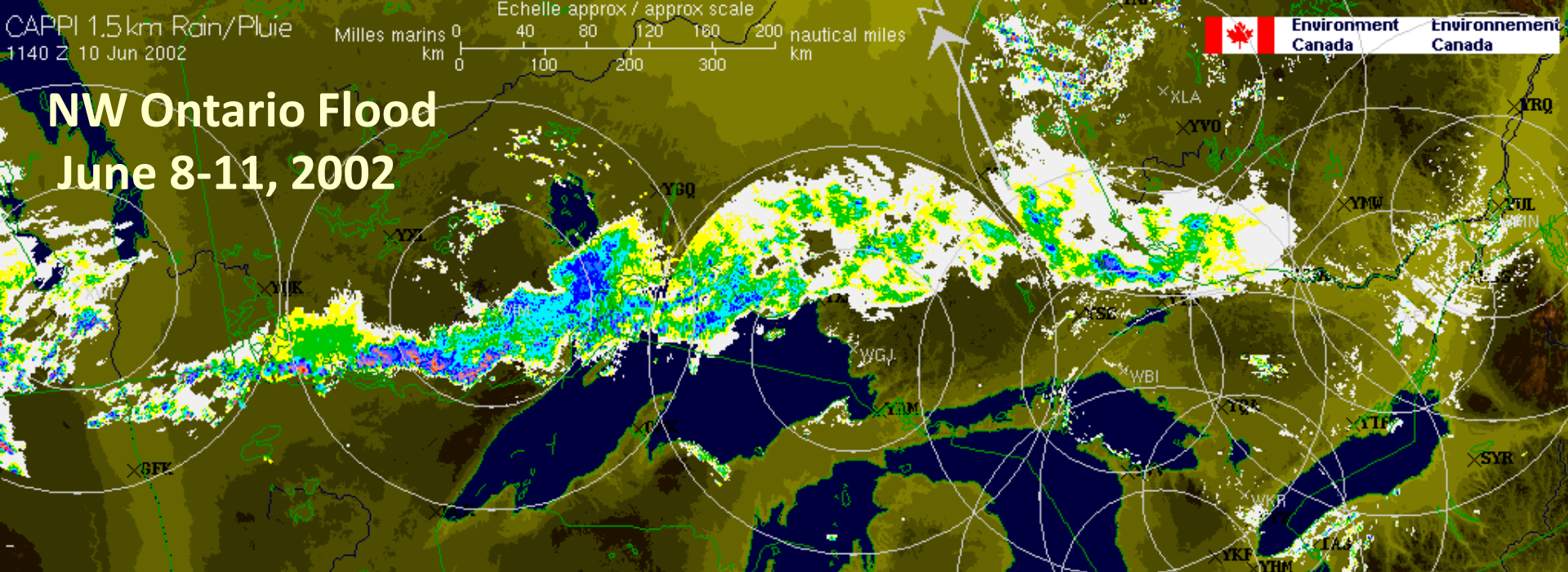
Toronto Finch Ave 2005: 175 mm; 103 mm in 1 hour in Downsview

Rainy River 360 mm in 48 hours over 100 km<sup>2</sup> area = 2 to 3 times the

Timmins (1961) Design Storm for Zone 2 in Ontario

Sudbury Sept 3 1970 : 112 mm in 24 hrs

## NW Ontario Flood June 8-11, 2002



- ~400 mm of rain in 48 hours over NW Ontario region bordering Manitoba and Minnesota
- Rainfall of over 360 mm for small basin area (100 km<sup>2</sup>) exceeded current regulatory flood “*Timmins Storm*” by 2 to 3 times for 48 hour period

*New “Design Storm” for this area based on this event ???*

## *Extreme Heat for Greater Sudbury Area*

Location	Station Period of Record (Years)	Extreme Maximum (°C) and Date Recorded (Period of Record)	Extreme Maximum (°C) and Date Recorded (1971-2000)	Extreme Maximum (°C) and Date Recorded (1990-2002/03)
Sudbury Area*	1887 – 2003	<b>38.3 °C</b> July 31, 1975	38.3 °C July 31, 1975	35.7 °C June 19, 1995
Coniston Area*	1921 – Oct 2002	<b>41.1 °C</b> July 13, 1936	37.5 °C June 19, 1995	37.5 °C June 19, 1995

\*Note: Sudbury Area data represents combined data from Sudbury and Sudbury A. Coniston Area data represents combined data from Coniston and Coniston STP.



# Hazard Identification and Risk Assessment

## HIRA SHEET # 1

**Event:**

**Type:**

**Score**

<b>Frequency</b>	4	High	Event(s) in the last 5 years.
	3	Medium	It has been 5-15 years since the last event.
	2	Low	It has been more than 15 years since the last event.
	1	Nil	It has never occurred in the Sudbury area.

<b>Probability</b>	3	Likely	Has occurred in the past and will occur again in the future.
	2	Possible	Could occur in the future.
	1	Unlikely	Has not occurred and will not in the future.

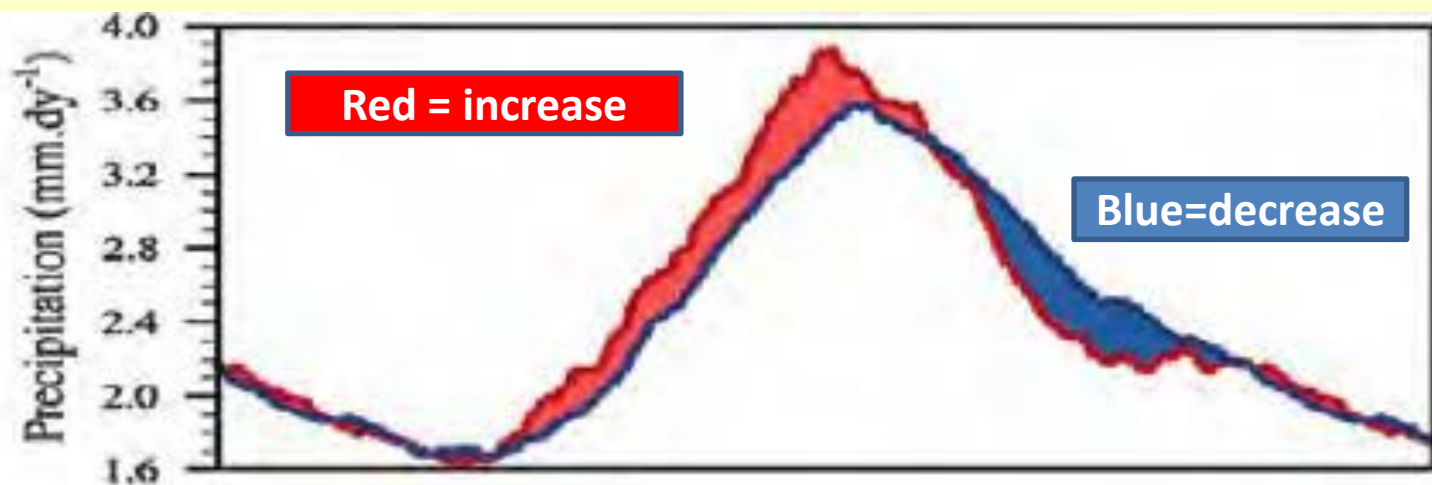
<b>Consequence</b>	4	High	Fatalities, severe damage, essential services out.
	3	Substantial	Widespread injuries/damage, basic services out.
	2	Limited	Some injuries, minor/localized damage.
	1	Negligible	Too small or unimportant to be worth considering.

Hazard	Ranking	Frequency	Probability	Consequences	Response Capabilities
Natural Events					
Human Health Emergencies	13	2	3	4	4
Floods	12	4	3	2	3
Fires (Forest and Wildland)	12	4	3	2	3
Extreme Cold	11	4	3	2	2
Ice / Sleet Storms	11	4	2	2	3
Tornadoes	11	2	2	4	3
Windstorms	11	4	3	2	2
Lightning and Thunderstorms	11	4	3	2	2
Extreme Heat	10	4	2	2	2
Blizzards	9	4	3	1	1
Fog	8	1	2	2	3
Agriculture and Food Emergencies	8	1	2	3	2
Earthquakes	8	1	2	2	3
Hailstorms	7	1	2	2	2
Hurricane	7	1	1	2	3
Drought	6	1	1	1	3
Total Hazard Events					

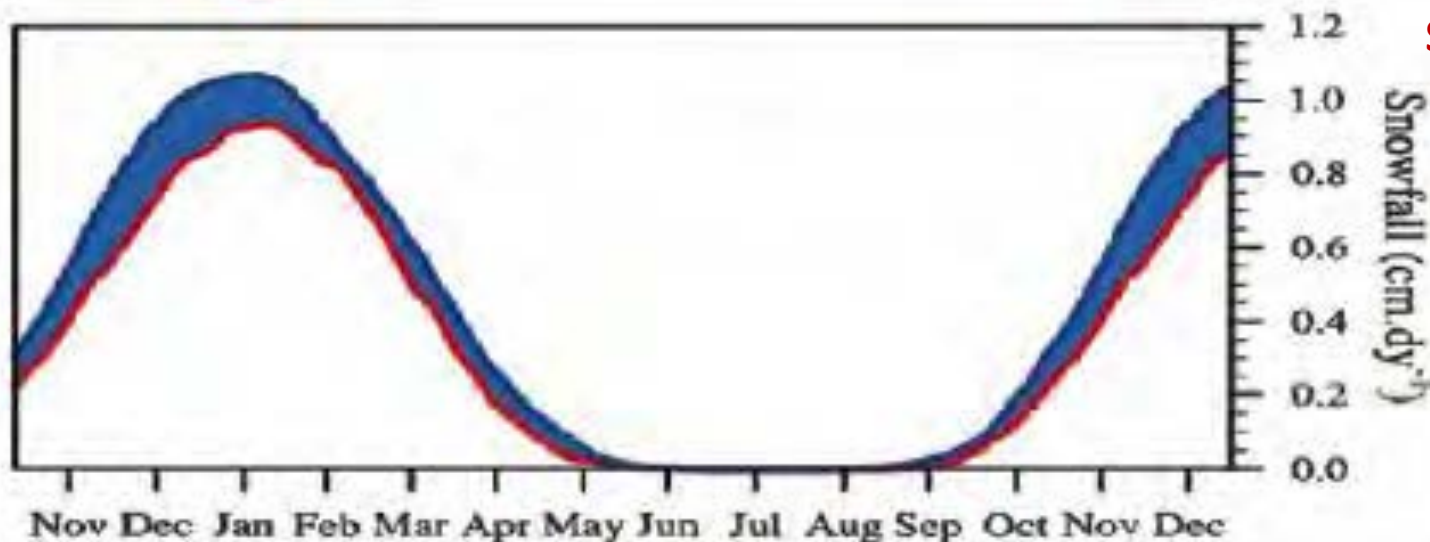


# Projected changes in the annual cycle of pptn and snowfall over the GL Basin in 2050s compared with 1970 - 2001

Pptn

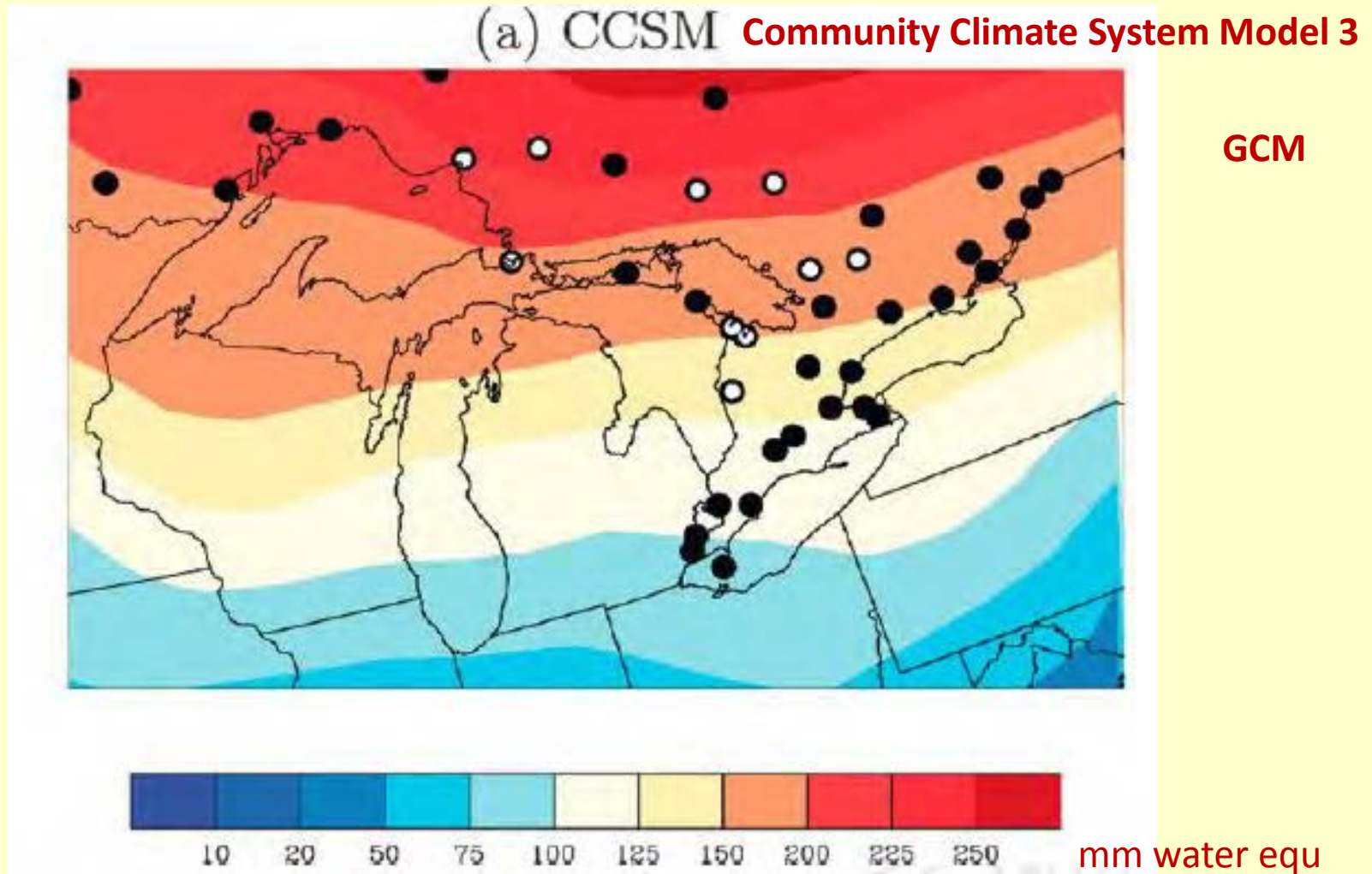


Snow





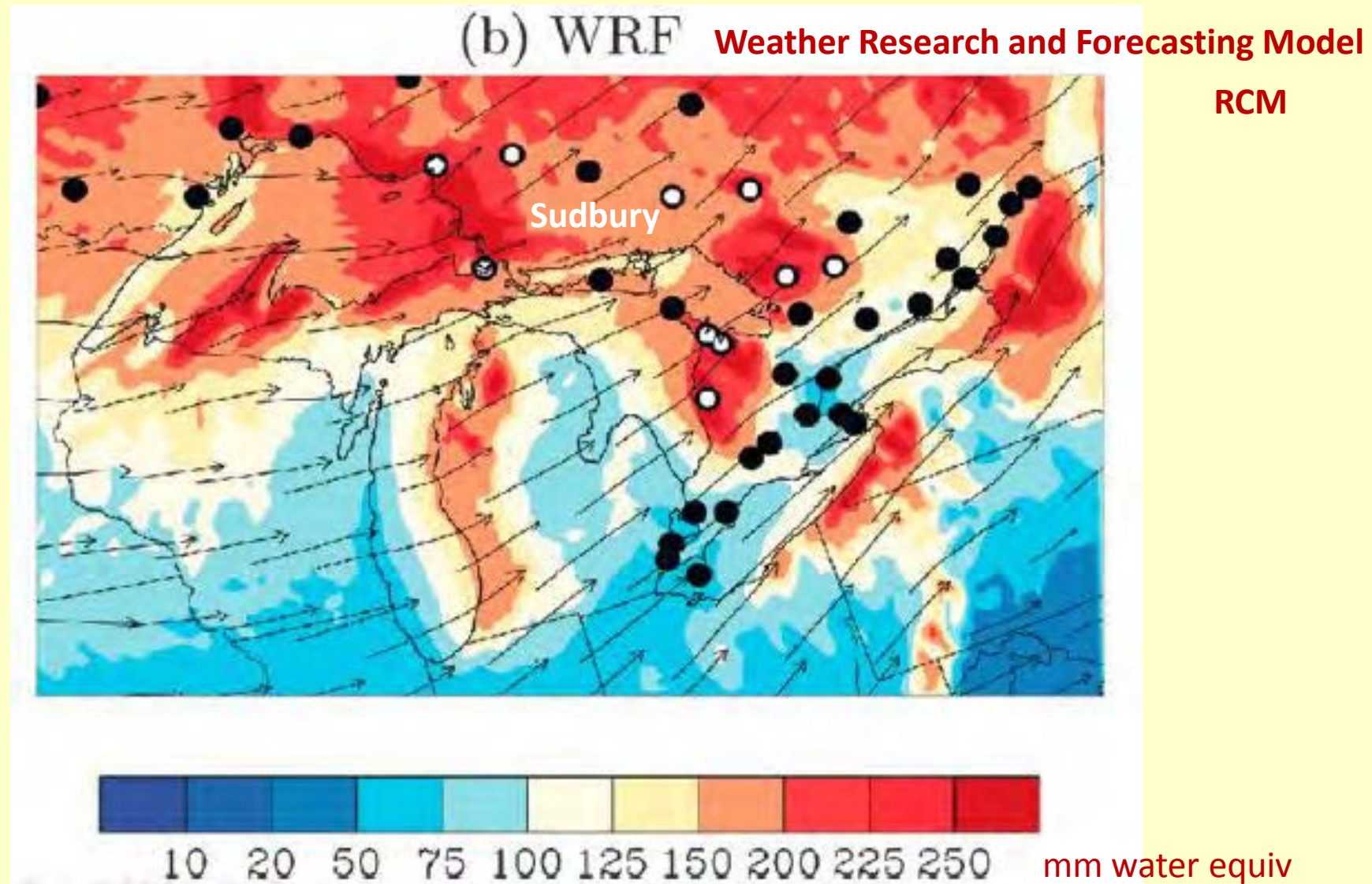
# Backcast of mean annual snowfall for 1970 – 2001



Gula and Peltier J Clim Nov 2012 *Dynamical downscaling over the Great Lakes Basin of North America using the WRF Regional Climate Model: The impact of the Great Lakes system on regional greenhouse warming.*

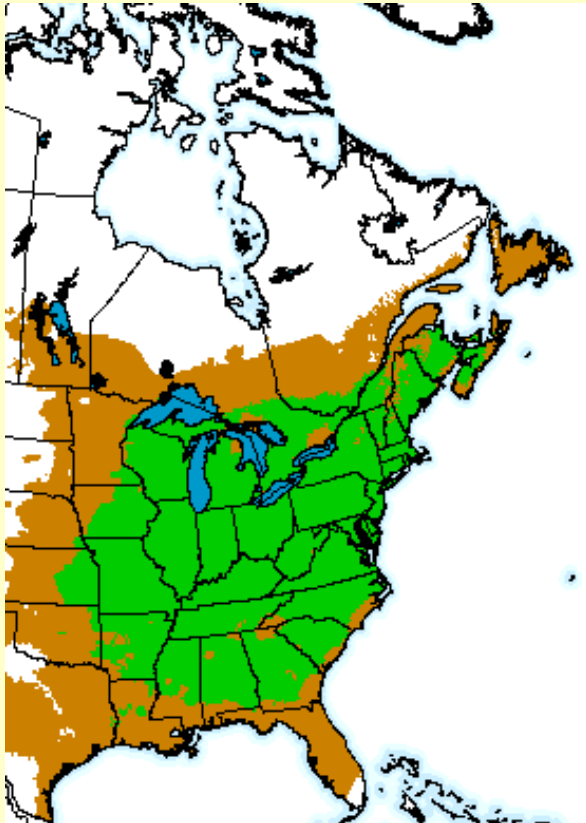


# Backcast of mean annual snowfall for 1970 – 2001

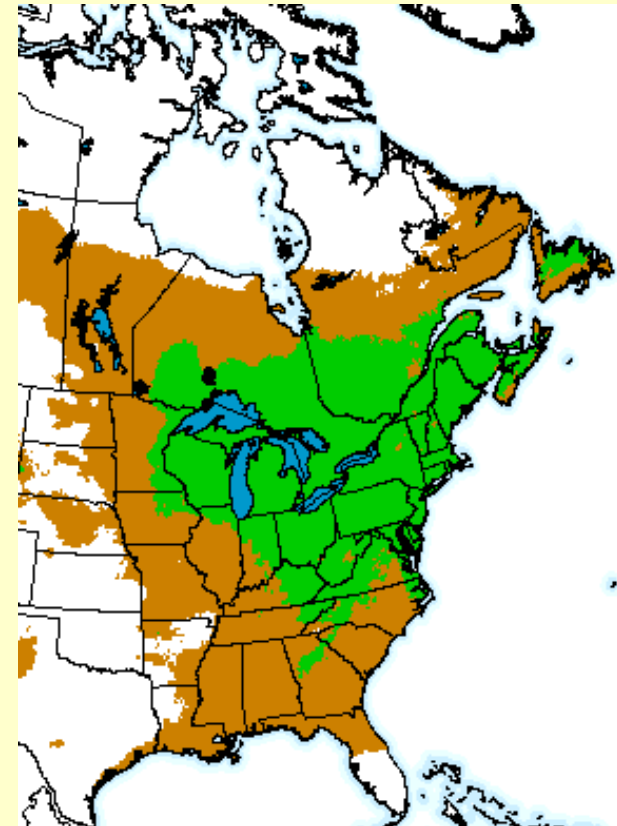


# Red maple (*Acer rubrum*)

**Today**



**Projected for 2050s**  
Based on temp and precip



[Plant Hardiness](http://gmaps.nrcan.gc.ca/phmapper/index)

<http://gmaps.nrcan.gc.ca/phmapper/index>

Climate model and scenario: ncarccsm3 A2



# Climate Change and the Official Plan

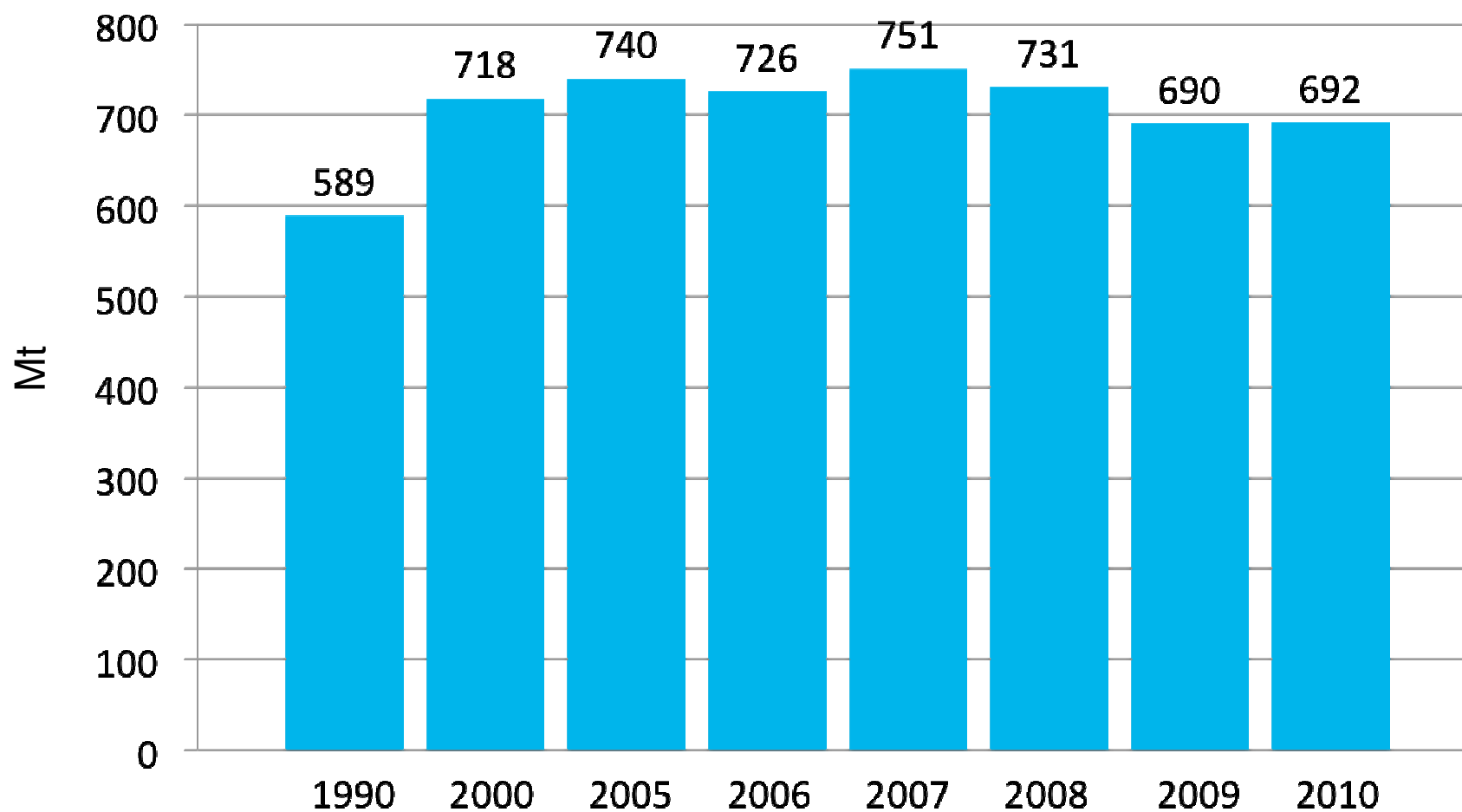
## A Strategic Discussion

Official Plan Review Workshop 11.20.12



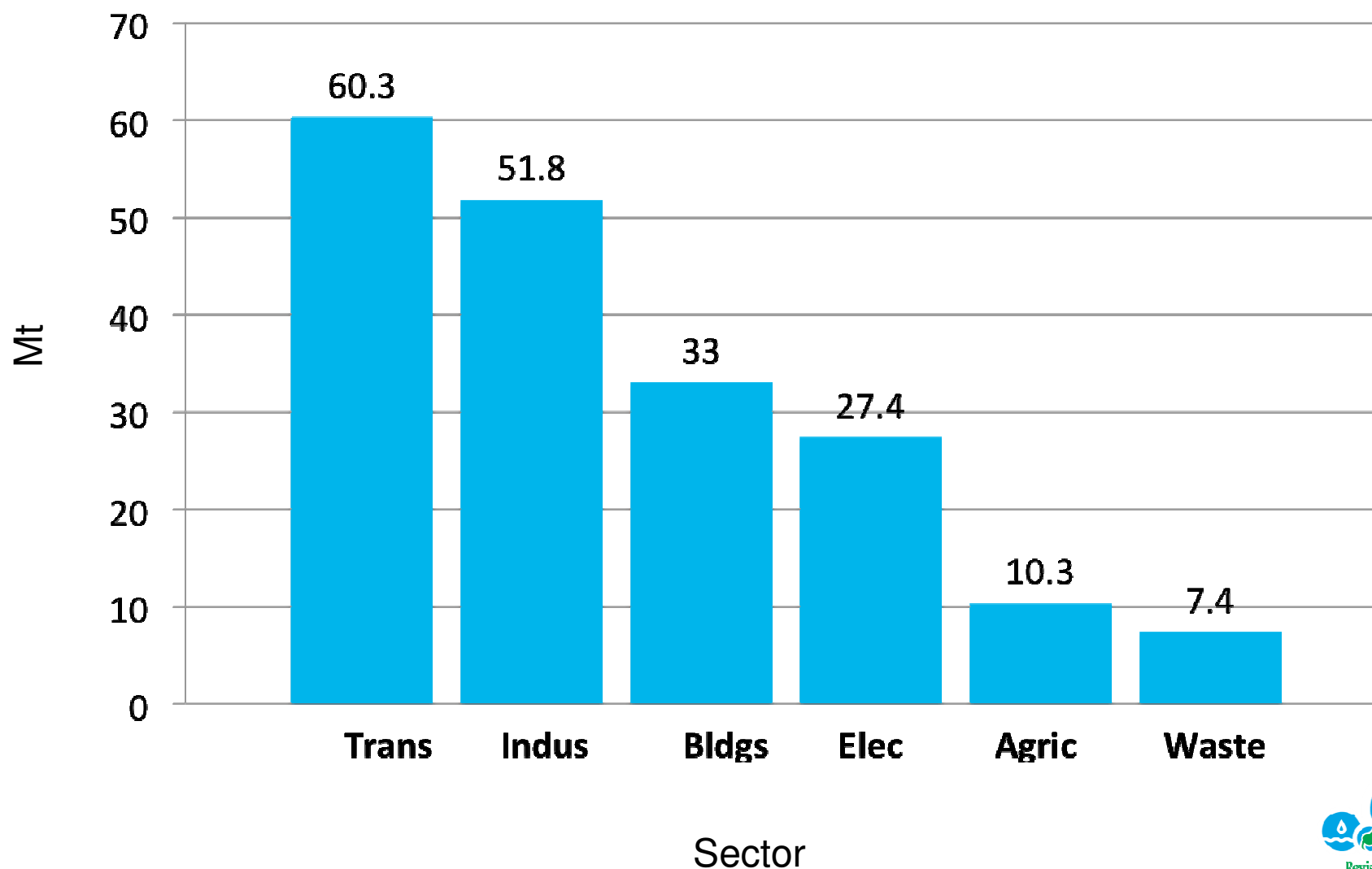


# Canada's GHG Emissions





# Ontario's Emission Sources 2008







# Why we are here today

Explore how the Official Plan can help:

1. Reduce risk
2. Strengthen resilience
3. Capitalize on opportunities



# The Official Plan

Strategic, long term planning document

Guides land use planning decision making

Balances a complex set of interests



**Changing Climate**



**Official Plan**



Growth management, planning and design



Mobility



Natural hazards



Water resources





# Growth, planning and design







# Draft provincial land use policies

“Land use patterns within settlement areas shall be based on densities and a mix of land uses which ... minimize negative impacts to air quality and climate change ... ”



# Draft provincial land use policies

**“Planning authorities shall support ... climate change mitigation and adaptation through land use and development patterns which:**

Promote compact form and a structure of nodes and corridors; ...

Improve the mix of employment and housing uses to shorten commute journeys and decrease transportation congestion;

Promote design and orientation which: maximizes energy efficiency and conservation, and considers the mitigating effects of vegetation; maximizes opportunities for the use of renewable energy; and takes into account the impacts of climate change;

Maintain or increase vegetation within settlement areas, where feasible.”



# Compact form policies

Establish a clear urban growth boundary

Delineate settlement area

Encourage intensification in settlement area

Permit higher residential densities

Direct higher densities to sites with services



# Node and corridor policies

## **Nodes:**

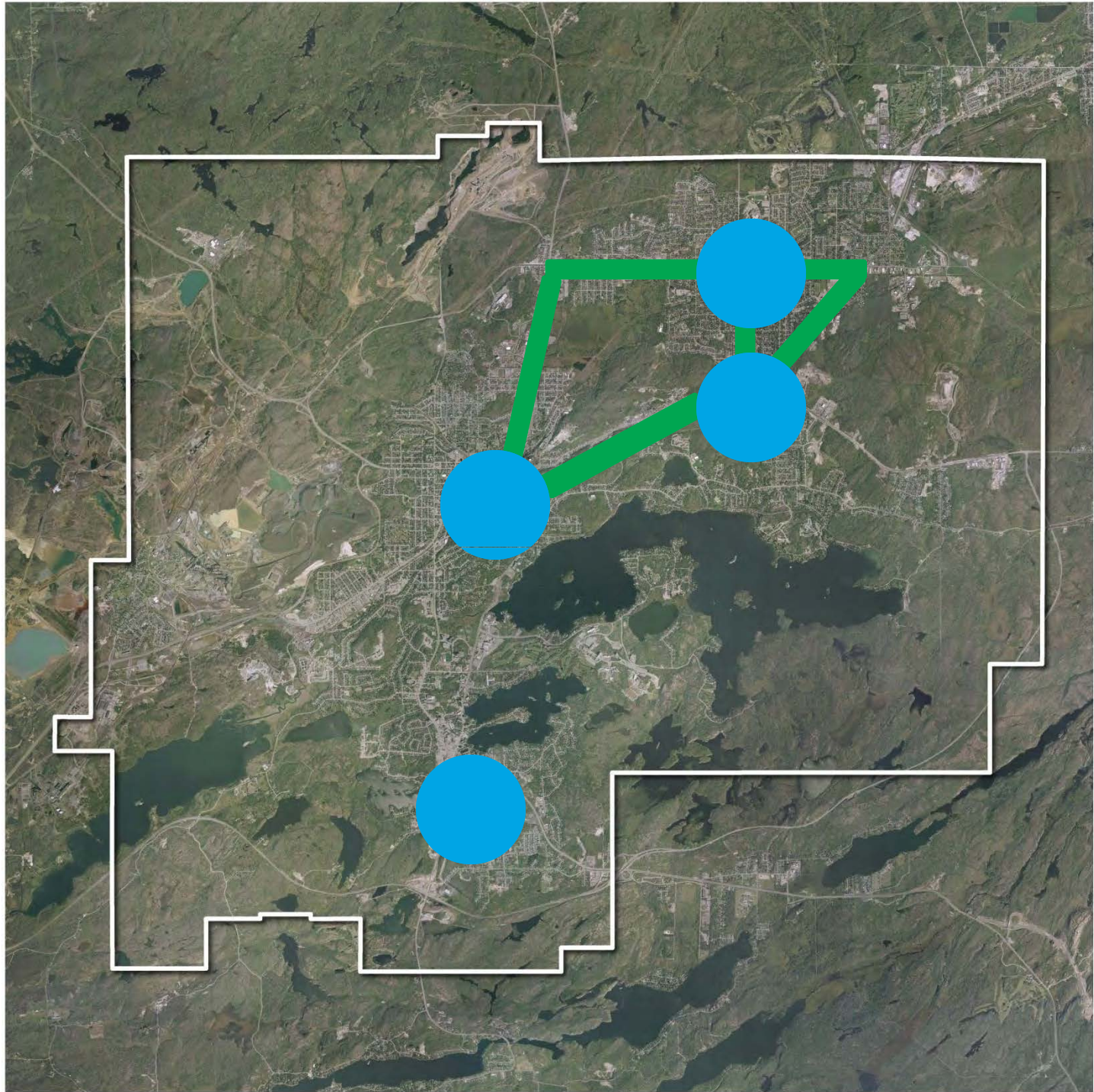
Downtown and Town Centres

Regional Centres

Employment Areas

## **Corridors:**

Mixed Use Commercial Arterial Roads







# Energy efficiency policies

Encourage building and landscape design practices that that conserve energy and reduce waste:

- Use energy efficient techniques and materials
- Site buildings to maximize passive solar gain
- Site buildings to capitalize on natural shade canopies
- Encourage compact, mixed use development
- Designing LEED standard buildings



# Increasing vegetation policies

Continue to support land reclamation

Protect and improve urban tree canopy

Provide trees in road improvement projects



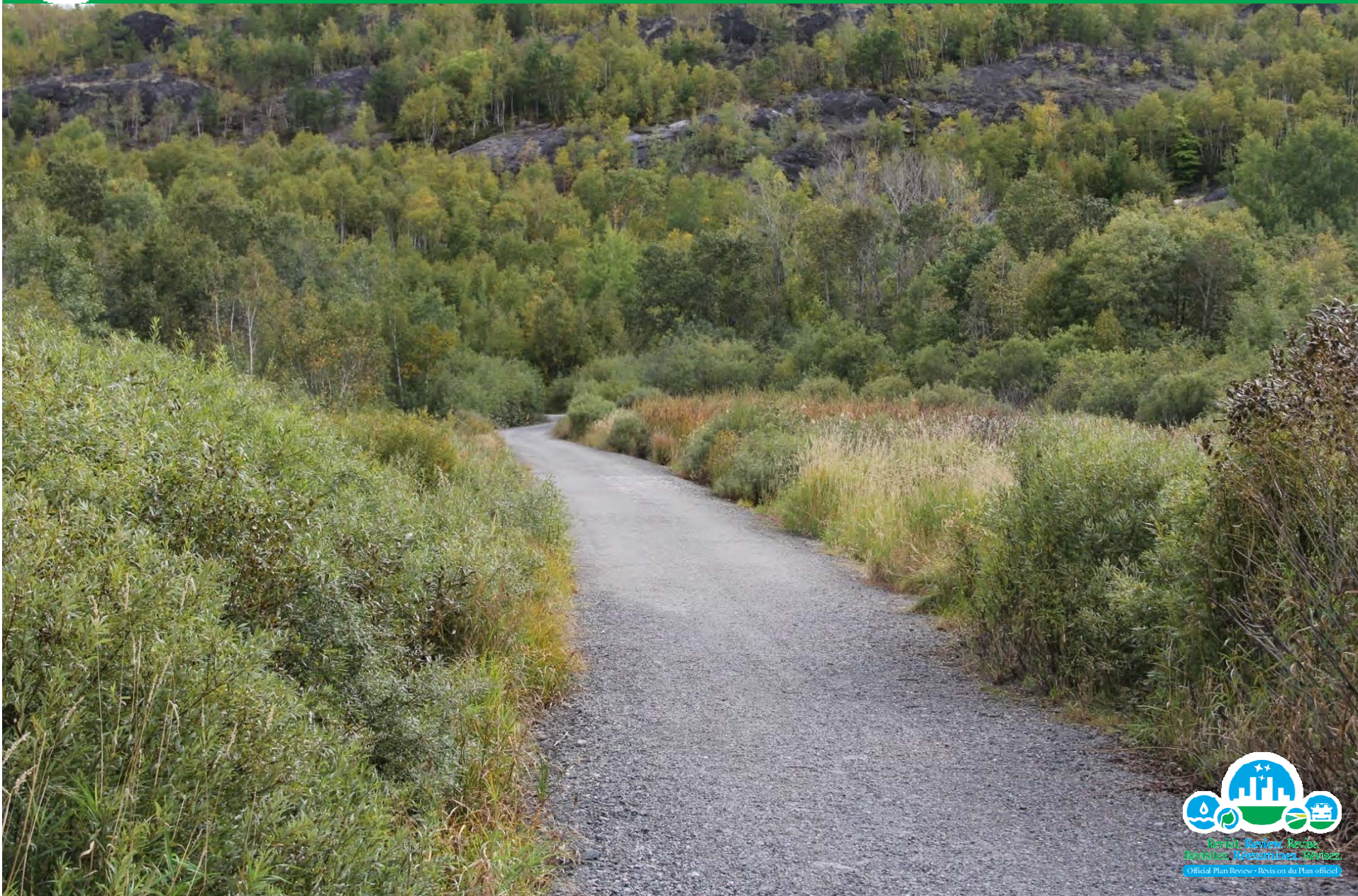
# Some key questions

1. Would additional carrots and sticks be useful to encourage more growth through intensification and reinforce the city's system of nodes and corridors?
2. Are additional policies/programs needed to further support consideration for the mitigating effects of vegetation during development approvals?
3. Are additional policies/programs needed to support the creation of more energy efficient neighbourhoods?
4. Are additional policies/programs needed to protect and grow the urban canopy?





# Mobility







# Draft provincial land use policies

**Planning authorities shall support ... climate change mitigation and adaptation through land use and development patterns which:**

Promote the use of active transportation and transit in and between residential, employment (including commercial, industrial and institutional uses) and other areas;

Focus major employment, commercial and other travel-intensive land uses on sites which are well served by public transit where this exists or to be developed, or designing these to facilitate establishment of transit in the future; ...”





# Active transportation policies

Maintain and expand pedestrian and cyclist network

Ensure adequate pedestrian access in all new developments

For new and reconstructed roads:

- Consider bike facilities
- Provide high quality pedestrian connections to transit
- Provide pedestrian connections between neighbourhoods
- Provide pedestrian linkages to major attractions/generators

Expand network with to connect major generators, communities, neighbourhoods and schools

Provide bike storage facilities at city buildings and parks

Encourage bike parking in new developments



# Public transit policies

Promote design that facilitates public transit provision

Review and orient new development to be within walking distance of a bus stop

Site buildings as close to the street as possible

Provide a continuous road grid, wherever possible

Integrate other active transportation elements with public transit

Integrate public transit into the long term planning of Employment Areas



# Some key questions

1. Are additional policies and/or programs needed to promote the use of active transportation between various areas of the city?
2. Are additional policies and/or programs needed to promote the use of transit between various areas of the city?



# Natural hazards





# Draft provincial land use policies

“Planning authorities shall consider the potential impacts of climate change that may increase the risk associated with natural hazards.”





# Types of natural hazards

Hazard lands adjacent to the shoreline of large inland lakes, river, stream and small inland lakes which are impacted by flooding hazards

Hazard lands associated with high to extreme risk of wildland fire



# Flood hazard policies

## Identify flood hazards

- Partial coverage
- Rivers and small inland lakes:  
100 year flood or regional storm event
- Lake Wanapitei and Panache:  
100 year flood plus wave uprush
- Special policies

## Restrict development



# Wildland fire hazards

“Development and site alteration may be permitted in hazard lands associated with high to extreme risk of wildland fire where the risk is mitigated in accordance with provincial wildland fire mitigation standards.”



# Some key questions

1. What design storm should be used to define the limit of the flood hazard?
2. What policies and/or programs are needed to ensure that the risk of wildland fire is assessed and mitigated during the development approval process?



# Water resources







# Public Feedback

The Official Plan should consider the impact of climate change on our water resources



# Various policy areas

Groundwater

Sourcewater

Watersheds

Quantity and quality

Character of development around lakes

Municipal water supply

Neighbourhood and building design

Stormwater management



# Water policies

Adopts a watershed approach

Protect the quality of drinking water resources

Protect sensitive groundwater features

Protect quality of lakes, rivers and streams

Provide effective stormwater management





# Other possible policy connections





# Climate Change and the Official Plan

## A Strategic Discussion

Official Plan Review Workshop 11.20.12





## Attachment B

### PPS Review – Select Draft Climate Change Related Policies

---

1.1.1 Healthy, liveable and safe communities are sustained by:

- a) promoting efficient development and land use patterns which sustain the financial well-being of the Province and municipalities over the long term;
- b) accommodating an appropriate range and mix of residential (including affordable housing), employment (including industrial, commercial and institutional uses), recreation, park and open space uses to meet long-term needs;
- c) avoiding development and land use patterns which may cause environmental or public health and safety concerns;
- d) avoiding development and land use patterns that would prevent the efficient expansion of *settlement areas* in those areas which are adjacent or close to *settlement areas*;
- e) promoting cost-effective development patterns and standards to minimize land consumption and servicing costs;
- f) improving accessibility for persons with disabilities by identifying, preventing and removing land use barriers which restrict their full participation in society;
- g) ensuring that necessary *infrastructure* and *public service facilities* are or will be available to meet current and projected needs; and
- h) promoting development and land use patterns that maintain biodiversity and resilience to climate change.

1.1.3.2 Land use patterns within *settlement areas* shall be based on:

- a) densities and a mix of land uses which:
  - 1. efficiently use land and resources;
  - 2. are appropriate for, and efficiently use, the *infrastructure* and *public service facilities* which are planned or available, and avoid the need for their unjustified and/or uneconomical expansion;
  - 3. minimize negative impacts to air quality and climate change, and promote energy efficiency;
  - 4. support *active transportation*;
  - 5. are *transit-supportive*, where transit is planned, exists or may be developed; and
  - 6. support the efficient movement of goods; and
- b) a range of uses and opportunities for *intensification* and *redevelopment* in accordance with the criteria in policy 1.1.3.3, where this can be accommodated

1.6.1 *Infrastructure* and *public service facilities* shall be provided in a coordinated, efficient and cost effective manner that considers impacts from climate change while accommodating projected needs.

- 1.8.1 Planning authorities shall support energy conservation and efficiency, improved air quality, and climate change mitigation and adaptation through land use and development patterns which:
- a) promote compact form and a structure of nodes and corridors;
  - b) promote the use of *active transportation* and transit in and between residential, employment (including commercial, industrial and institutional uses) and other areas;
  - c) focus major employment, commercial and other travel-intensive land uses on sites which are well served by transit where this exists or is to be developed, or designing these to facilitate the establishment of transit in the future;
  - d) focus freight-intensive land uses to areas well served by major highways, *airports*, *rail facilities* and *marine facilities*;
  - e) improve the mix of employment and housing uses to shorten commute journeys and decrease transportation congestion;
  - f) promote design and orientation which:
    - 1. maximizes energy efficiency and conservation, and considers the mitigating effects of vegetation;
    - 2. maximizes opportunities for the use of renewable energy; and
    - 3. takes into account the impacts of climate change; and
  - g) maintain or increase vegetation within *settlement areas*, where feasible.
- 3.1.3 Planning authorities shall consider the potential impacts of climate change that may increase the risk associated with natural hazards.
- 3.1.8 Development and site alteration may be permitted in hazardous lands associated with high to extreme risk of wildland fire where the risk is mitigated in accordance with provincial wildland fire mitigation standards.