Climate Change & Manitoba

Impacts, & Adaptation
Overview

1. How is our climate CHANGING?
2. What potential IMPACTS?
3. How can we ADAPT?
How is our climate changing?
Global temperatures 1884 - 2010
Summer Mean Temperature Trend
1970-2007
Fall Mean Temperature Trend
1970-2007

Data Source: AHCCS (http://www.canmet.ec.gc.ca/ahccs/)

Created by Dr. Brian Elder and Ryan Smith, University of Winnipeg, 2008
Winter Mean Temperature Trend
1970-2007

Data Source: AHCCS (http://www.cwme.aq.gc.ca/aah/cn/cn.html)
Created by Dr. Stanley Miller and Ryan Smith, University of Winnipeg, 2008
The earth will likely get warmer

- Average global temperature **may increase 1.1°C to 6.0°C** in the **next 100 years**

- Average global temperature **increased 0.74°C** in the **last 100 years** (IPCC 2007)
Computer model projection

What potential IMPACTS?
Manitoba impacts

- Rising permafrost temperatures — causing roads, railways, and building foundations to buckle and deteriorate.
- Thinning ice — polar bears can't hunt, losing weight, losing cubs.
- Reduced river flow from Rocky Mountain sources — less water for hydro generation.
- More forest fires consuming vast areas of this vital resource and risk of more disease in forests.
- Drought conditions as seen in the past few years, but more frequent and for longer durations.
- Changing ecological conditions — grasslands will move further north, forcing out our boreal forests.
- Significantly less snow cover — less moisture for agriculture.
- Greater risk of flooding — like 1997's "Flood of the Century" or worse.
Heat waves

Number of days with temperatures > 30°C, during observed and future time periods

(Hengeveld et al., 2005)
• Health risks

• Europe 2003
  • 35,000 people died
  • More heat waves + more air pollution = asthma, respiratory illness, (esp. children, elderly)
Permafrost

- **Foundations**
  - Homes
  - Buildings

- **Transportation**
  - Railway lines
  - Roadways
  - Runways

Photos: Natural Resources Canada
Pests and diseases

- **Mountain Pine Beetle**
  - Devastated BC
  - Increasing in Alberta

- **Spruce budworm**
  - More infestations in higher latitudes
Infectious diseases

• Range moving north
  • insects
  • ticks
  • rodents

• Faster maturation
• Longer season
Infectious diseases

- Increase of current vector-borne infectious diseases
  - Equine encephalitis
  - Rocky Mountain spotted fever
  - West Nile virus (WNV)
  - Hantavirus

- New infectious diseases
  - Malaria
Precipitation changes

IPCC 2007 A1B scenario comparing the period 2080 to 2099 with the control period 1980 to 1999
Precipitation changes

IPCC 2007 A1B scenario comparing the period 2080 to 2099 with the control period 1980 to 1999
Annual precipitation trends (% change) observed between 1948 and 2003. (The "X" symbols indicate where trends are statistically significant) Source: Zhang et al. 2000, 2005
Precipitation - seasonal

Seasonal change in precipitation by the 2050s (relative to 1961-1990), based on the median of seven global climate models and using the emissions scenarios of the Special Report on Emissions Scenarios (SRES)
Spring floods

St Jean Baptiste April 2011

PHOTO: Joe Bryksa / Winnipeg Free Press
Red River basin

- Annual precipitation and the annual streamflow volume might increase
- Flood start time and peak time might shift earlier
- Warmer temperatures result in smaller floods occurring earlier
Loss of Stationarity

- **Stationarity:**
  - the notion that *seasonal weather and long-term climate conditions fluctuate within a fixed envelope of relative certainty*

“The issues are so immense and complex in **Manitoba** that this province - and not the Arctic - may become Canada’s first climate casualty.”

—Bob Sandford in Manitoba during FLOW’s 2011 national discussion series tour

Building, road, bridge, sewage design assumptions no longer represent reality

Bob Sandford, Director of the Western Watersheds Climate Research Collaborative (WWCRC)
Severe weather events

- More frequent
- More severe

- Hailstorms
- Tornadoes
- Thunderstorms
- Intense rainfall
Severe rainfall events

Steinbach, July 25, 2012
The unexpected

Ochre Beach, May 13, 2013
Droughts

- **Evaporation**
  - increases at higher temperatures
    - + crops stress
    - + pest and disease vulnerability
- **Could offset benefits of longer growing season**
Food & water contamination

• Outbreaks of
  • E. Coli
  • Cryptosporidium
  • Giardia
  • Typhoid
  • Amoeba

• Food-borne illness
Lake Winnipeg

- **Stress on Lake Winnipeg**
  - Zooplankton may disappear
    - South basin 30 years +2°C
  - Algae blooms
Lowered freshwater levels

- Hydroelectric generation
How can we ADAPT?
Resilience
Without fossil fuels:

- **Water**
  - Flood
  - Drought
  - Contamination

- **Food**
  - Cost
  - Availability

- **Energy**
  - Heat
  - Transportation
Clean water

• **Protect sources**
  • Prevent contamination
    • aquifer
    • reservoir

• **New sources**
  • Rainwater

• **Reduce usage**
  • Composting toilets
  • Efficiency
  • Greywater
Healthy, **local** food

- **Production**
  - Community gardens
  - Northern greenhouses
  - Vegetables

- **Processing**
  - Packing

- **Storage**

- **Distribution**
  - Markets
Transportation

• **Reduce the need**
  - Local production
  - Logistics
  - Hi-speed Internet

• **Alternative modes**
  - Electric charging network
  - Active transportation
  - Airships & pilots
  - Regional bus service
  - Car share (fleet / public)

- **Stop expanding roadways** (infill)
- **Maintain existing infrastructure**
Heat / electricity

- **Envelope**
  - Passive House

- **Source**
  - Biomass (Non-food)
  - Geothermal (Utility)
  - Solar (Passive)

- **Distribution**
  - Co-generation
  - District heating
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