Health Consequences of Climate Change

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Climate change is the greatest global health threat of the 21st century …”

"The effects of climate change are being felt today and future projections represent an unacceptably high and potentially catastrophic risk to human health."

The Science is Clear: Vital Signs

warming over the past century is not in doubt

Carbon Dioxide

Temperature:

For the last 10,000 years average global temperatures have been around 14°C. However in the last 100 years this has started to change.

http://www.bbc.co.uk/education/guides/z3bbb9g/revision/5
2016 Set to be the hottest year on record globally.

UK Met Office estimates 2016 will be at least as hot as 2015, the three hottest years ever had occurred in a row.
Canadian Temperature Trends, 1948 - 2012

Rising Sea Levels

Dangerous global warming will happen sooner than thought - study

Australian researchers say a global tracker monitoring energy use per person points to 2C warming by 2030
“Athabasca Glacier could disappear within generation”

Global Context

“The microbe is nothing—the milieu everything.”

“Chance favors the prepared mind”

Louis Pasteur
Climate Change in Canada

Canada is affected disproportionately,

its rate of warming is about twice the global rate
Direct impact on health

Heat, Extreme weather events, Droughts, Floods
Extreme Weather Events

Selected Significant Climate Anomalies and Events in 2015

**ALASKA**
- The year 2015 tied with 2002 as the second warmest year since statewide records began in 1925, behind 2014.

**CANADA**
- Parts of western Canada had their warmest summer on record. Moderate to extreme drought developed across parts of western Canada due to the unusual warmth and dryness.

**ARCTIC SEA ICE EXTENT**
- During its growth season, the Arctic had its smallest annual maximum extent. During its melt season, the Arctic reached its fourth smallest minimum extent on record.

**CONTIGUOUS UNITED STATES**
- The contiguous U.S. had its second warmest summer and third wettest year since national records began in 1895. May 2015 was the warmest month of any month on record.

**EUROPE**
- Europe as a whole, experienced its second warmest year on record, behind 2014. Several countries had a top 5 year for warmest, including Austria (3rd), Germany (2nd), France (5th), and The Netherlands (8th).

**INDIA**
- A major heatwave affected India from 21 May – 10 June. Average temperatures over 45°C were observed, with some locations reaching 48°C. Over 2000 fatalities were blamed on the excessive heat.

**CHINA**
- Heavy rain from May-Oct caused floods that affected 75 million people. Provinces in southern China experienced their wettest May in 40 years.

**WESTERN PACIFIC OCEAN**
- Typhoon season above average activity 26 storms, 2 typhoons

**CYCLONE CHAPALA**
- (October 26-November 4, 2015)
  - Maximum winds ~250 km/hr
  - Chapala was the first hurricane-strength storm in the Saffir-Simpson scale on record to make landfall in Yemen.

**HURRICANE SANDRA**
- (November 23-28, 2015)
  - Maximum winds ~230 km/hr
  - Sandra was the latest major hurricane observed in the Eastern North Pacific basin since reliable records began in 1971.

**MEXICO**
- Several major systems brought heavy precipitation during March 2015, with the national average being over three times the monthly average. This was the wettest March since national records began in 1941.

**EASTERN NORTH PACIFIC HURRICANE SEASON**
- Above average activity 14 hurricanes

**CHILE**
- Jan 2015 was the driest Jan in at least five decades.

**ARGENTINA**
- Second warmest year, behind 2012, since national records began in 1961. The four warmest years on record have occurred since 2012.

**SOUTH AMERICA**
- Much warmer than average conditions existed much of the region during the year, resulting in the warmest year since continental records began in 1946.

**SOUTH AFRICA**
- Jul 2014 – Jun 2015 was the driest since 1991/92 and third driest since records began in 1932/33.

**SOUTH WEST INDIAN OCEAN CYCLONE SEASON**
- Near average activity 13 storms, 6 cyclones

**SOUTH PACIFIC OCEAN CYCLONE SEASON**
- Near average activity 6 storms, 2 cyclones

**AUSTRALIA**
- Experienced its fifth warmest year since national records began in 1910. The month of October was exceptionally warm, recording the largest anomaly for any month on record.

Please Note: Material provided in this map was compiled from NOAA’s NCEI State of the Climate in 2015 and the WMO Provisional Status of the Climate in 2015.
“Increased risk of extreme weather events: all areas of Canada.”

Fort MacMurray Fires: Malissa Holstein describes leaving the city in packed-motorhome as ‘apocalyptic.’

By Abby Schneid
BC News Posted: May 04, 2016 5:42 PM CT Last Updated: May 04, 2016 9:02 PM CT

California: Wild Fires

Source: California Fire Service
‘Summer of Smoke, 2015’
Number of Forest Fires by Province, 2015
Health Effects of Forest Fires

- Respiratory
- Cardiovascular
- Mental Health
- Physical Health
- Mortality

Image: http://www.cbc.ca/news/canada/north/n-w-t-fires-kakisa-survives-highway-3-re-opens-1.2696334
Rising Sea Levels

Flooding in Sena, Thailand. 2011. (Sukree; Reuters Sept 13 2011)
No more Conferences in Vancouver?
Five Pacific islands lost to rising seas as climate change hits

Sea levels set to 'rise far more rapidly than expected'
(Re-)Emerging Infectious Diseases
Vector-borne infectious diseases with Positive Climate Sensitivity

• Mosquito-borne
  • Malaria and Dengue

• Tick-borne
  • Tick-borne encephalitis and Lyme

• Other vector borne
  • Plague and Hemorrhagic Fever with Renal Syndrome (HFRS)

Global Distribution of Infectious Disease:
Dengue Fever

http://seeg.oox.ac.uk/themes/infectious-disease-atlas
Infectious disease in Canada

- **Increased incidence** of vector-borne infectious diseases native to Canada (e.g., eastern & western equine encephalitis, Rocky Mountain spotted fever)

- **Introduction** of infectious diseases new to Canada

- Possible **emergence** of new diseases, and **re-emergence** of those previously eradicated in Canada
Air pollution
Stratospheric ozone depletion

- More cases of sunburns, skin cancers, cataracts and eye damage
- Various immune disorders
Flooding
in Haiti
Drought in California

Drought Has Expanded, Intensified Across State

Statewide Drought Measurements From U.S. Drought Monitor, Taken Around October 1 Each Year

Legend:
- Abnormally Dry
- Moderate Drought
- Severe Drought
- Extreme Drought
- Exceptional Drought

Drought and Famine

- 2011 East Africa / Horn
- 13 million affected, 500,000 dead
- Extreme Weather Event
- Directly attributed to anthropogenic climate change

Food Insecurity in Southern African Region

- Reduced yields
- 29 Million

Table 1: Estimated number of current food insecure population in the Southern Africa region*

<table>
<thead>
<tr>
<th>Country</th>
<th>Rural Population</th>
<th>Affected Population</th>
<th>% of Rural Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angola</td>
<td>12,767,654</td>
<td>800,000</td>
<td>6.3%</td>
</tr>
<tr>
<td>Botswana</td>
<td>875,105</td>
<td>30,318</td>
<td>3.5%</td>
</tr>
<tr>
<td>DR Congo</td>
<td>40,970,888</td>
<td>6,591,535</td>
<td>16.1%</td>
</tr>
<tr>
<td>Lesotho</td>
<td>1,541,072</td>
<td>463,936</td>
<td>30.1%</td>
</tr>
<tr>
<td>Madagascar</td>
<td>15,727,662</td>
<td>459,319</td>
<td>2.9%</td>
</tr>
<tr>
<td>Malawi</td>
<td>14,492,248</td>
<td>2,833,212</td>
<td>19.5%</td>
</tr>
<tr>
<td>Mozambique</td>
<td>18,384,814</td>
<td>137,784</td>
<td>0.7%</td>
</tr>
<tr>
<td>Namibia</td>
<td>1,276,090</td>
<td>370,316</td>
<td>29.0%</td>
</tr>
<tr>
<td>South Africa</td>
<td>18,828,580</td>
<td>14,069,662</td>
<td>74.7%</td>
</tr>
<tr>
<td>Swaziland</td>
<td>1,011,606</td>
<td>200,897</td>
<td>19.9%</td>
</tr>
<tr>
<td>Tanzania</td>
<td>35,762,641</td>
<td>424,136</td>
<td>1.2%</td>
</tr>
<tr>
<td>Zambia</td>
<td>9,168,601</td>
<td>798,948</td>
<td>8.7%</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>10,174,849</td>
<td>1,490,024</td>
<td>14.6%</td>
</tr>
</tbody>
</table>

*Source: USGS-EROS and UCSB.
Food Insecurity (stunting, M/PEM)
Water Security
Worsening Dynamic: CC & Fragile States

- War & Displacement
- Food Insecurity
- ERIDS
“Amid the diverse social and political causes, the Darfur conflict began as an ecological crisis, arising at least in part from climate change.”

- Ban Ki Moon UNSG
Climate change in the Fertile Crescent and implications of the recent Syrian drought

Colin P. Kelley\textsuperscript{a,1}, Shahrzad Mohtadi\textsuperscript{b}, Mark A. Cane\textsuperscript{c}, Richard Seager\textsuperscript{e}, and Yochanan Kushnir\textsuperscript{c}

Timeline of Events
Prior to the 2011 Uprising

1970s-1990s
Agricultural policies promote production of staple crops, leading to increase in number of groundwater wells and use of inefficient and outdated irrigation methods


2003-2010:
Iraqi and Syrian Refugees and Internally Displaced Persons (IDPs) Net Urban Influx [in Millions]

Syrian IDPs

Iraqi Refugees

12 March, 1971
Hafiz al-Assad becomes president of Syria

Syria achieves self-sufficiency in wheat production

Drying of the Khabur River in NE Syria

Since 2005
Apartment prices in Damascus have more than doubled
Winter 2007-08:
Driest in observed record
Since 2007
Wheat, rice, and feed prices have doubled

March 2011
Uprising in Syria

Fig. S1. Timeline of events leading up to the civil uprising that began in March 2011, along with a graph depicting the net urban influx (in millions) of Syrian IDPs and Iraqi refugees since 2005.

60 Million IDPs & Refugees
Conflict is regional, borderless, porous with global impacts
The Top Five Risks X 10 Yrs

For the next 10 years:

- Water crises: 39.8%
- Failure of climate-change mitigation and adaptation: 36.7%
- Extreme weather events: 26.5%
- Food crises: 25.2%
- Profound social instability: 23.3%

VUCA world – volatile, uncertain, complex & ambiguous

- Discontinuous with the past
- Accelerating rate of change
- Multiple & converging crises
- Climate, Ecology, Energy, IFF, Food, ERIDS
- Urbanization / population
- 01% vs 99.99%
- GOVERNANCE
While neither actions alone can prevent climate change impacts, taken together they can reduce the risks.
Adaptation: to reduce the damages from climate change, that cannot be avoided

Mitigation: to reduce the rate and magnitude of climate change
Adaptation: what can be done?

- Improved management of the environmental determinants of health (such as water and sanitation)
- Infectious disease surveillance
- Strengthening the resilience of health systems to extreme weather events
- Alleviation of poverty

Mitigation, and its “co-benefits”

Many mitigation programs to reduce climate change, also lead to direct health benefits (called co-benefits).
Through climate change mitigation, there is **synchronicity** in the promotion of **individual** and **community** health.

Climate change is (also) a crucial **clinical** and **GLOBAL public health** challenge.
Early Warning Systems to Anticipate, Absorb & Reshape for Healthy Communities
Role of doctors and the Canadian Medical Association

In recent years the health community has been much more visible in framing climate change as a health issue.
Problem of the Global Commons

Climate Change has local impacts, but is a global problem requiring global/national action

- That forefronts local and community based responses
“A response by the WMA … to the challenges imposed on health and healthcare systems by climate change.”
On behalf of its members, the WMA committed to:

- **ADVOCACY** to combat global warming
- **LEADERSHIP** for adaption and mitigation
- **EDUCATION** and **CAPACITY-BUILDING**
- **RESEARCH** and **SURVEILLANCE**
Canadian Medical Association Declaration, 2010

The CMA policy called for action by health authorities to address climate change in Canada, in five main areas:

- **EDUCATION** and **CAPACITY building**
- **SURVEILLANCE** and **RESEARCH**
- **REDUCING THE BURDEN OF DISEASE** to mitigate climate change impacts
- **PREPARING** for climate emergencies
- **ADVOCACY** to combat climate change
Responding to climate change is NOT (only) a scientific/technological issue.

Much of scientific/rational/managerial thought and approaches to ‘nature’ and ‘humans’ have led us to the global planetary crises.
CMA: Courage!! Step up & Out !!!

- Cdn Coal Phase Out
- 80% Fossil Fuels Need to be left in the ground
- Fracking
- Education materials and policy perspectives
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