effectiveness of public health and public policy in adapting to climate change in industrialized countries

Tom Kosatsky, MD

Environmental Health Services

BCCDC

Regina/PHAC/2012

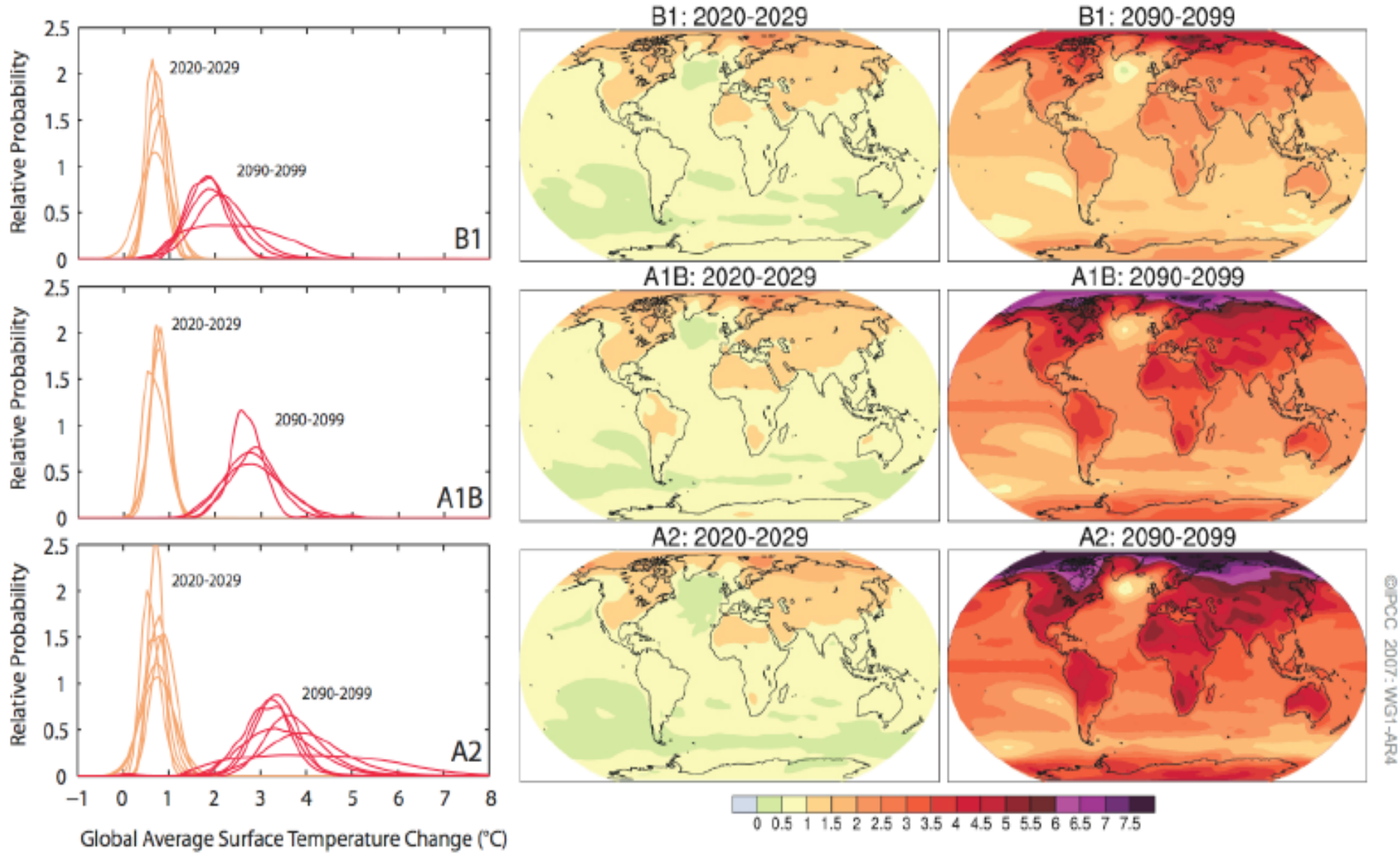
BC Centre for Disease Control
An agency of the Provincial Health Services Authority

National Collaborating Centre for Environmental Health
Centre de collaboration nationale en santé environnementale

Climate change is one of the greatest challenges of our time . . . and will affect, in profoundly adverse ways, some of the most fundamental determinants of health: food, air, water.

Dr. Margaret Chan, WHO, 2008

AOGCM Projections of Surface Temperatures



changes in the probability of extreme weather events

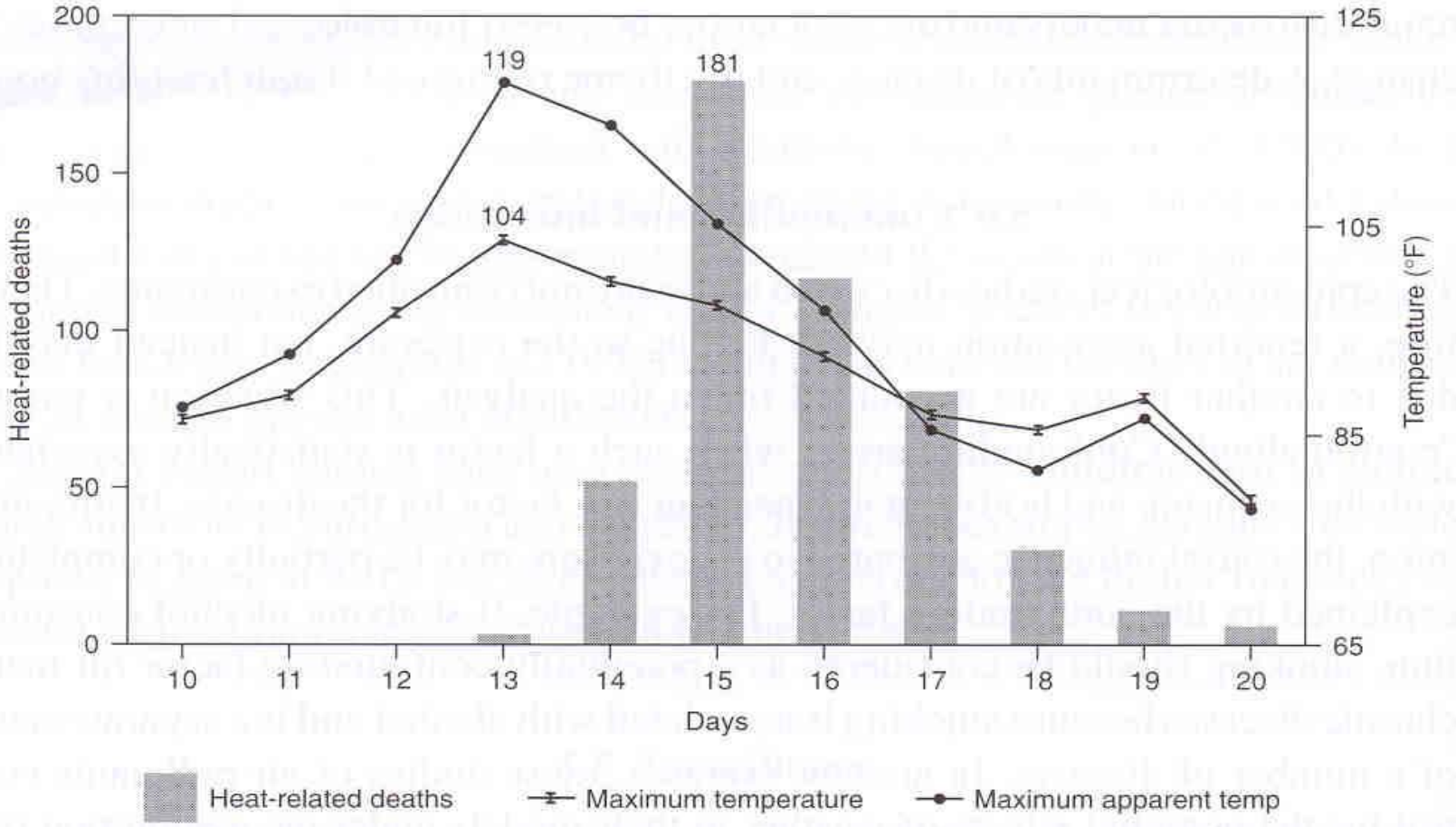
- warmer mean temperatures
- more temperature variability

- ***warmer, longer and more frequent extreme heat events***

- continued and perhaps more frequent cold events

heat-related deaths in Chicago during July 1995

Whitman,1997

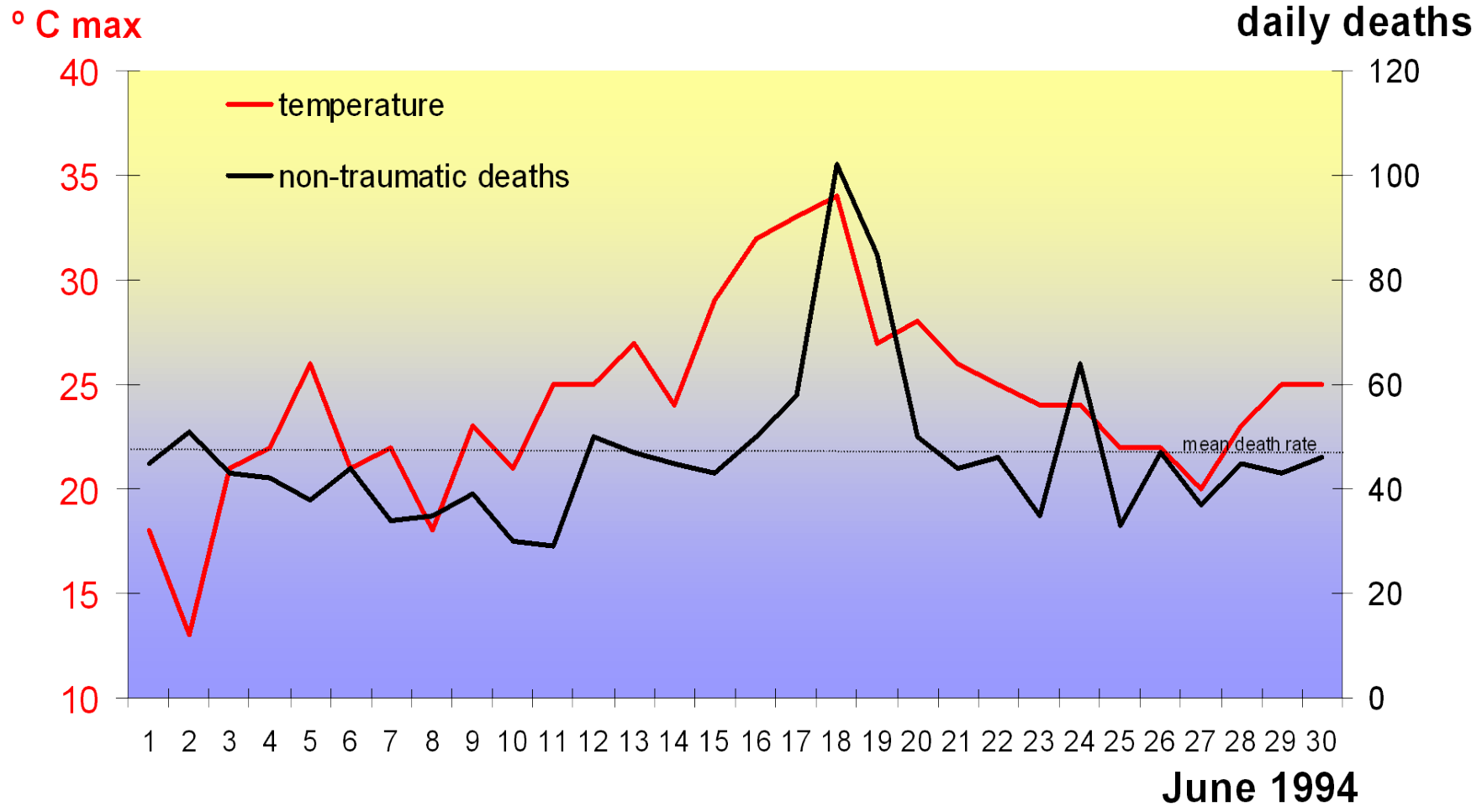


heat wave, Chicago 1995

refigerator trucks outside City morgue

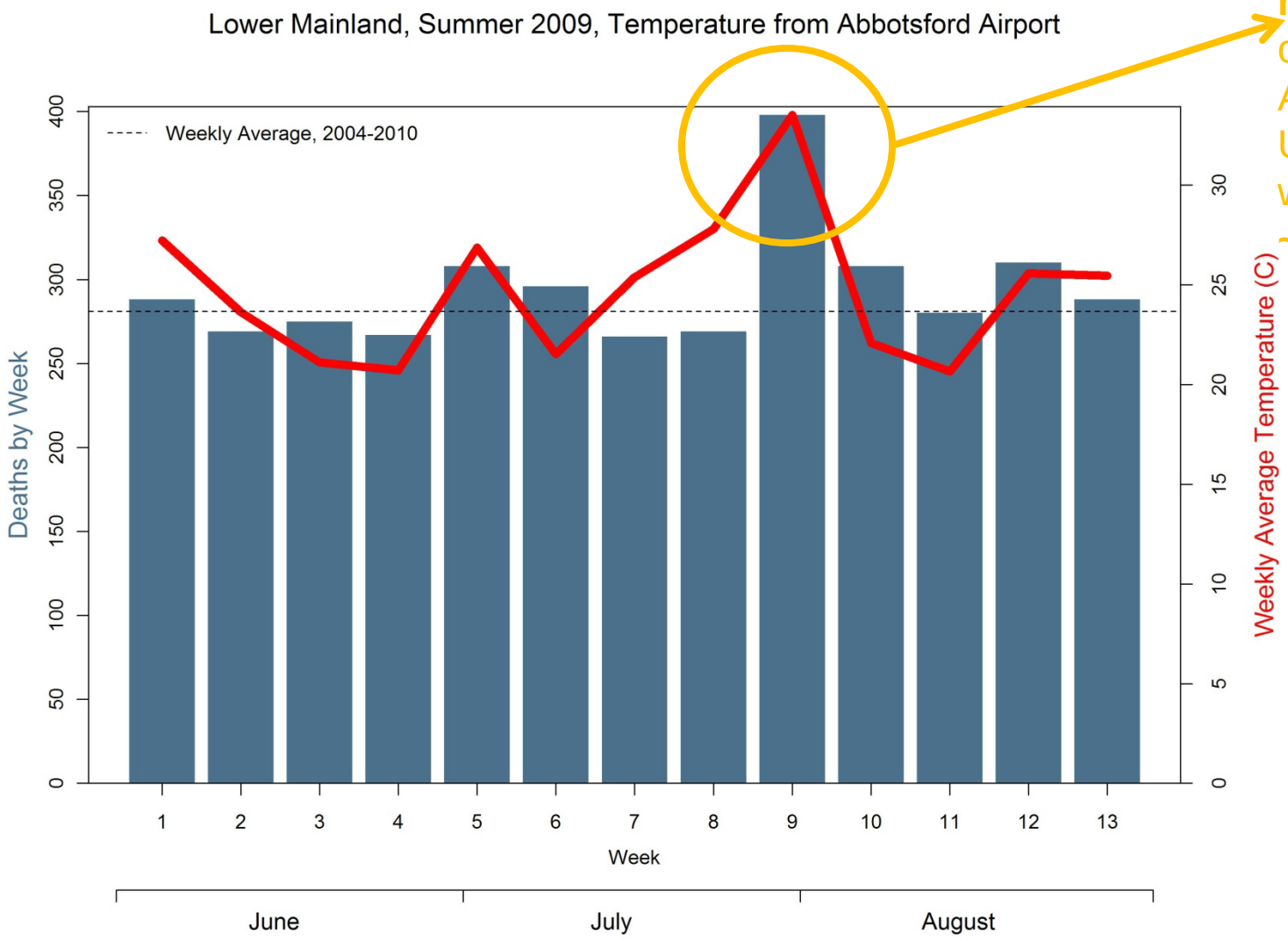
Klinenberg, 2002

Montreal : June 1994 heat wave with attendant mortality



Kosatsky, 2005

BC Lower Mainland **weekly** mortality, 2009



hottest 7-day period on record (Abbotsford Airport) since 1986. Unprecedented event was associated with **~122 excess deaths**:

Weekly average deaths 2004-2010 = 281 (stable over this period)

who died and where during 2009 Vancouver heat event and during comparison weeks

Table 2: Logistic regression results for the case-only models. All models adjusted for age and/or sex where appropriate. Shaded areas indicate statistically significant results with a = 0.05.

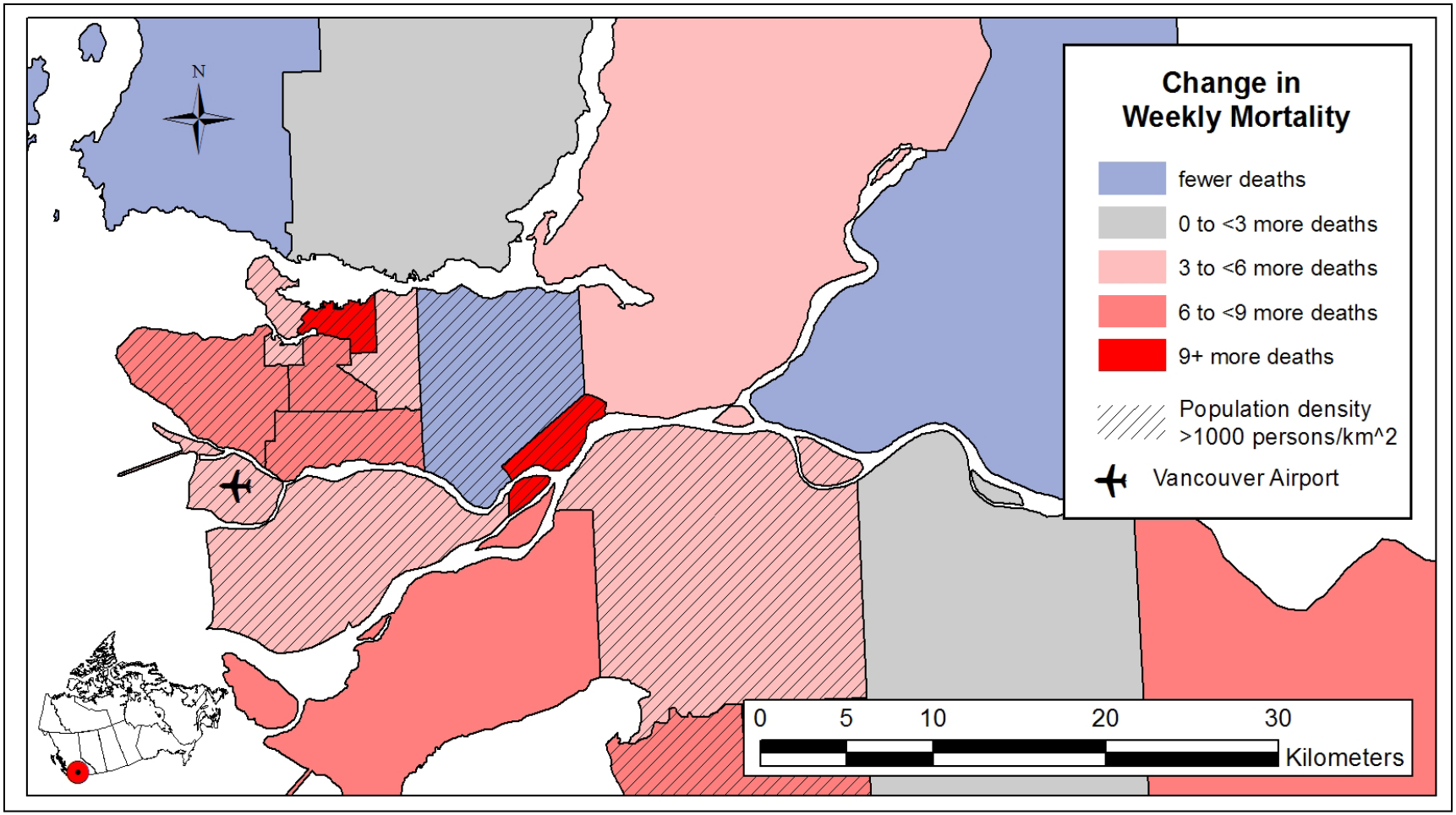
		8 Previous Weeks Summer 2009	8 Same Weeks Summers 2001-2008	*4 Same Weeks Summers 2005-2008*
Characteristic	Comparison Group	OR (95% CI)	OR (95% CI)	*OR (95% CI)*
<65	≥ 85	1.10 (0.82-1.49)	0.95 (0.70-1.29)	*0.99 (0.71-1.38)*
65 – 74	≥ 85	1.47 (1.06-2.03)	1.03 (0.75-1.42)	*1.35 (0.94-1.93)*
75 – 84	≥ 85	1.02 (0.76-1.36)	0.88 (0.66-1.17)	*0.97 (0.71-1.32)*
Male	Female	1.12 (0.90-1.39)	1.09 (0.88-1.36)	*1.08 (0.85-1.37)*
Died outside institution*	Died in institution	1.43 (1.10-1.86)	--	*1.42** (0.94-2.14)*
>1000 persons/km^2	≤1000 persons/km^2	1.26 (1.02-1.58)	1.32 (1.06-1.65)	*1.43 (1.13-1.82)*
>40% of 65+ living alone	≤40% of 65+ living alone	1.23 (0.88-1.72)	1.07 (0.77-1.49)	*1.12 (0.78-1.61)*
>20% under LICO†	≤20% under LICO	1.17 (0.94-1.45)	1.23 (1.00-1.52)	*1.34 (1.07-1.70)*

* Institutions include hospitals and care residences.
** Data available for 2008 only.
† The before-tax low income cut-off as defined by Statistics Canada

Kosatsky, 2012

changes in BC Lower Mainland mortality by population density

hottest summer 2009 week, versus 8 weeks before



Kosatsky, 2012

levels of heat-health prevention

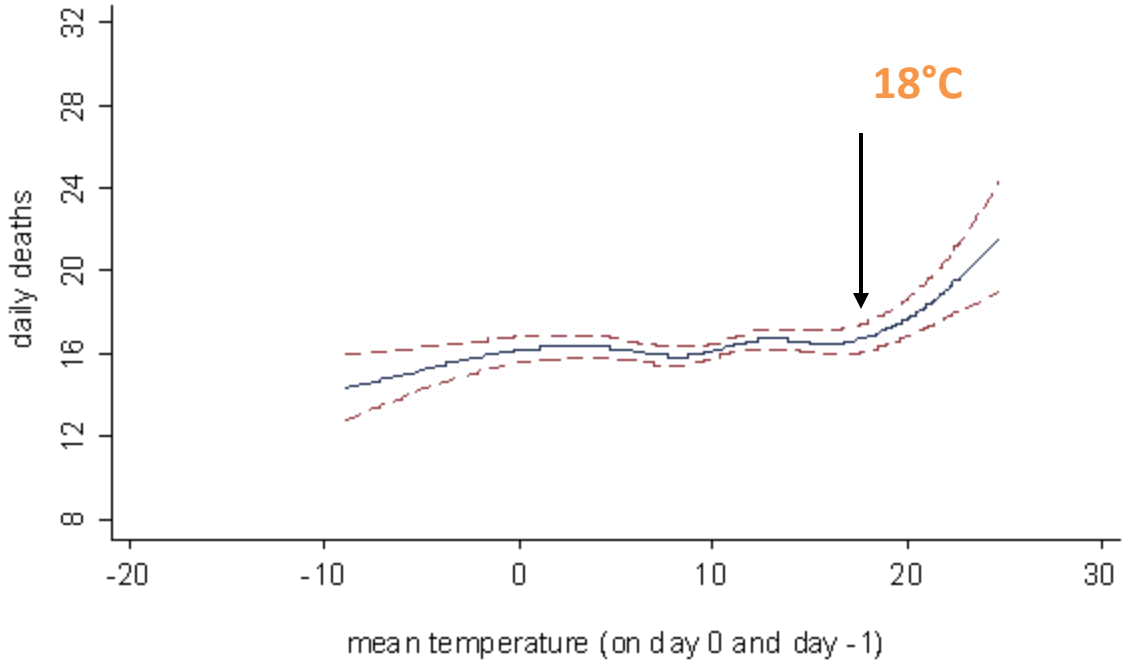
- Rapid treatment
- Hot day messaging/protective response
- Identification of susceptibilities / pre-heat wave adaptation
- Increase personal and social resilience
- Urban adaptation
- Greenhouse gas reduction

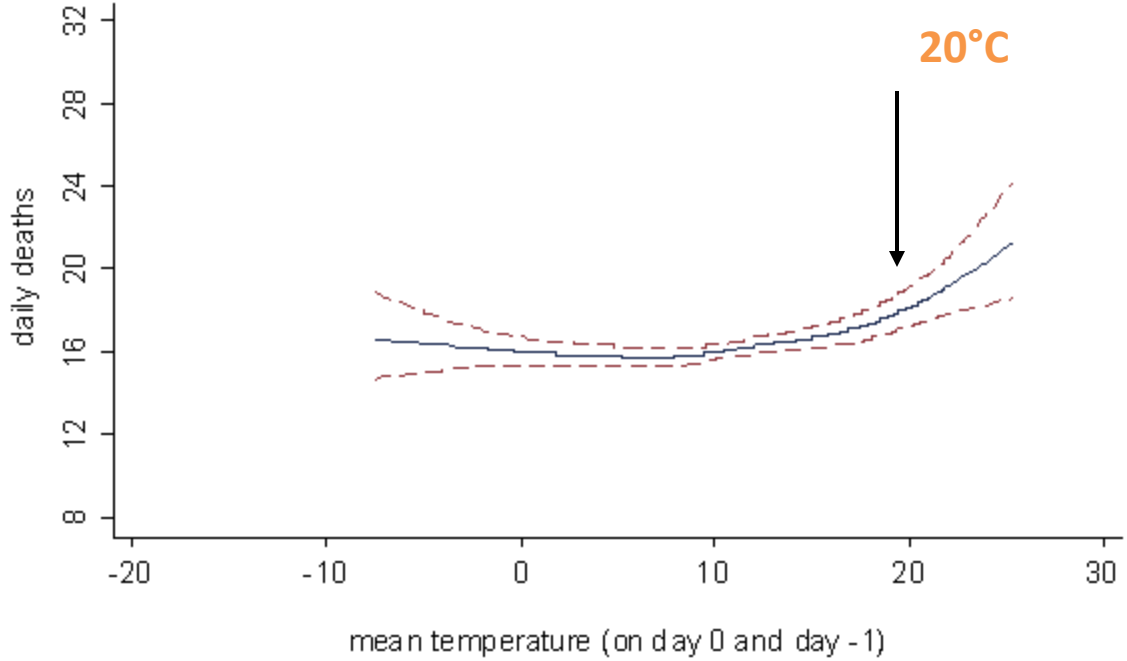
levels of heat-health prevention (*public health roles*)

- Rapid treatment
- Hot day messaging/protective response (*promotion, communication*)
- Identification of susceptibilities / pre-heat wave adaptation (*assessment, protection*)
- Increase personal and social resilience (*community development*)
- Urban adaptation (*health evidence, advocacy*)
- Greenhouse gas reduction

daily deaths (all ages, all cause) for Vancouver North Metropolitan area associated with temperature at Vancouver Airport,

1986-1996





1997-2008

change in risk of hot-day death, 1960-1990, New York City

Kalkstein,1999

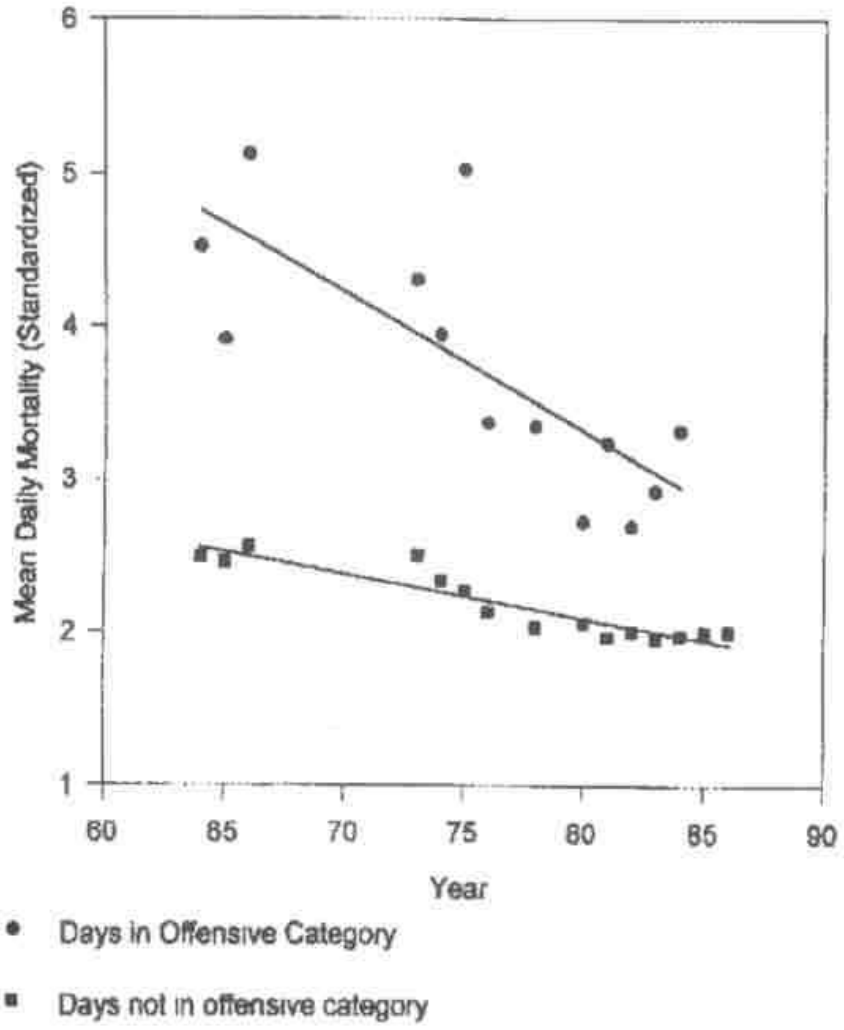
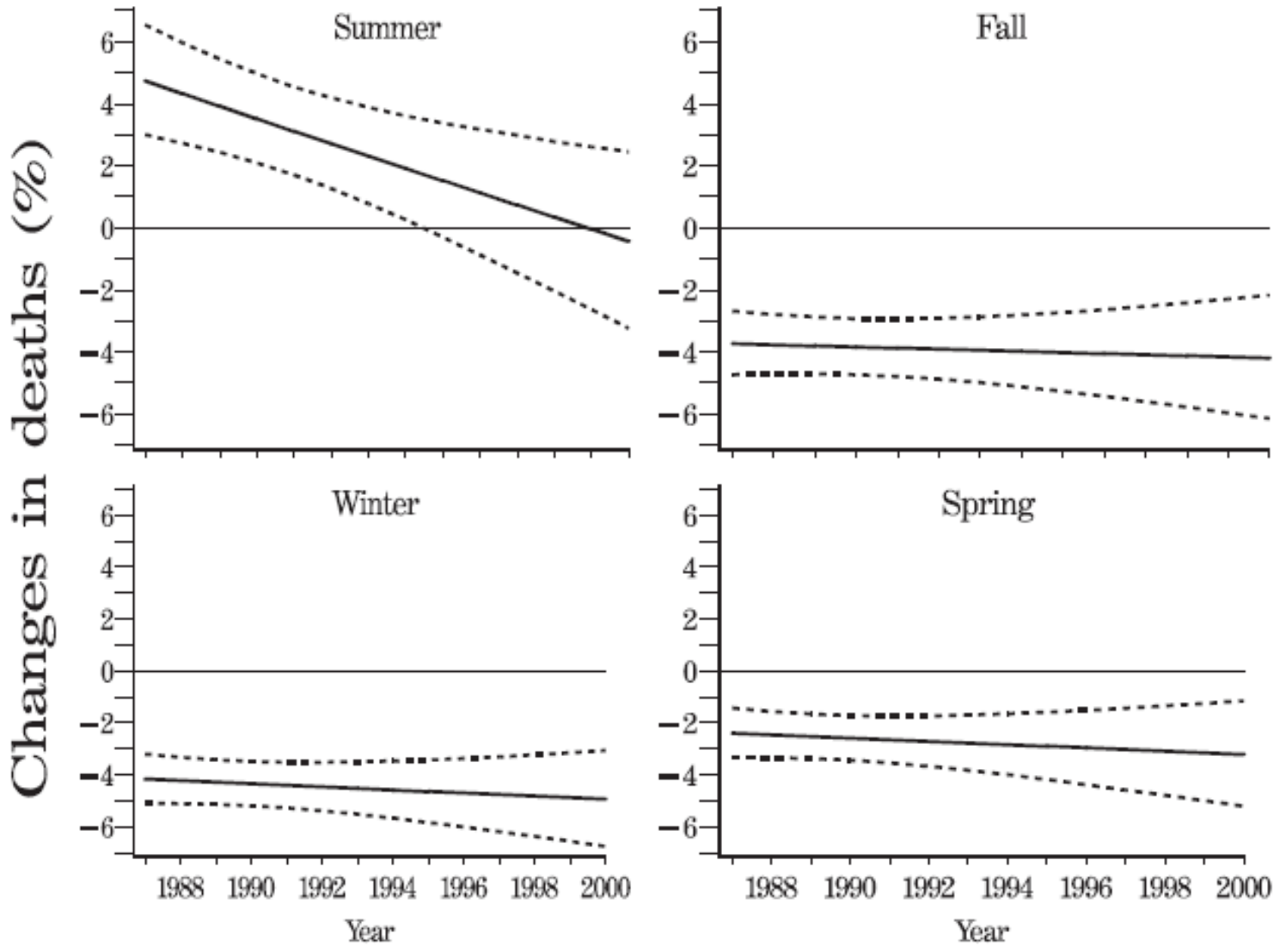


Fig. 4. Treads of mean daily mortality, New York, 1960–1990

mean changes in daily cardiovascular deaths (%) and 95% posterior intervals due to a 10°F increase in temperature by year and season, US cities Barnett, 2007



changes in the probability of extreme weather events

- warmer mean temperatures
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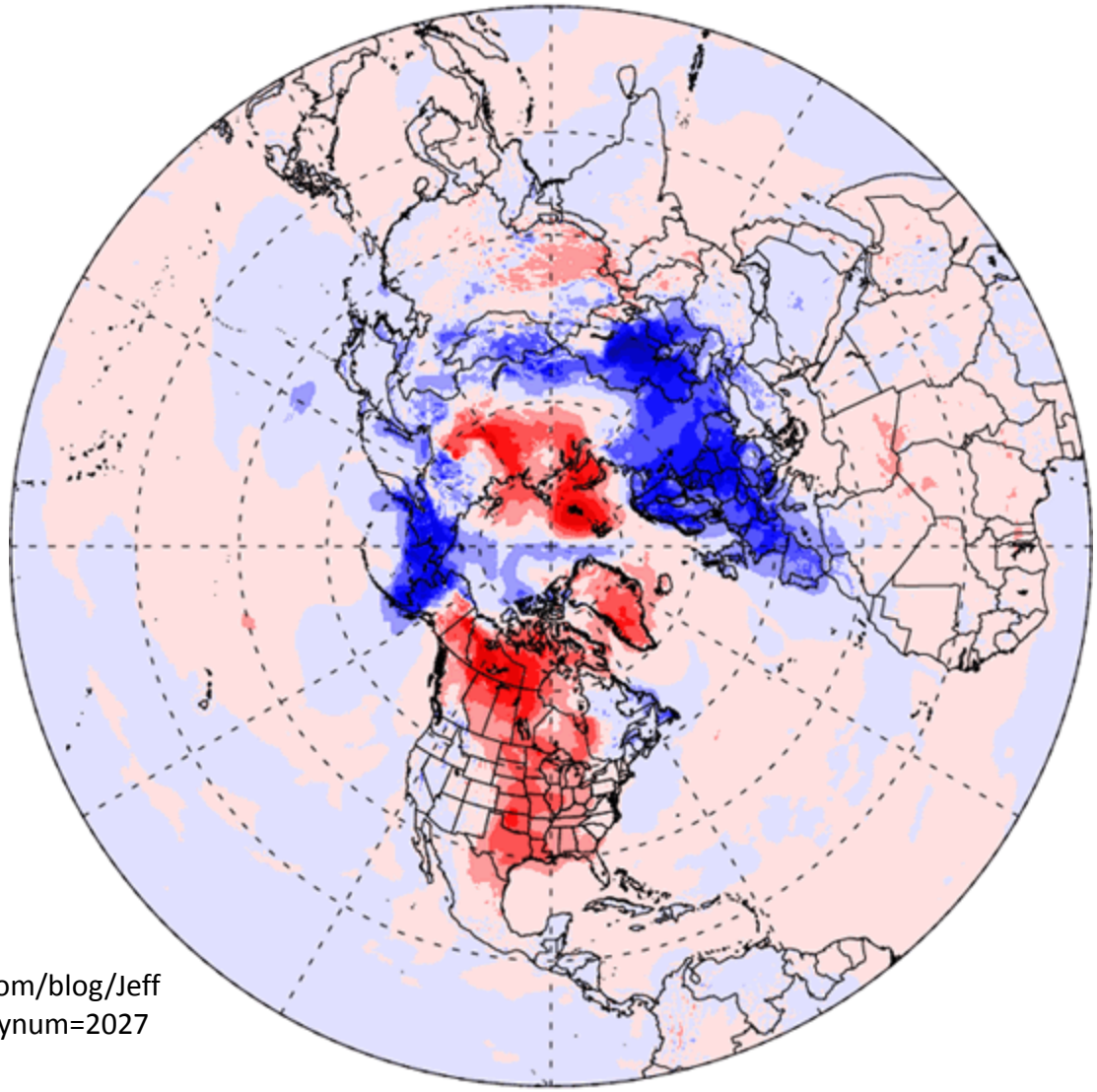
cold spell, New Brunswick, 2012

CBC. 26 January 2011.

Departure of Temperature From Average, Feb 2, 2012



-42 -35 -28 -21 -14 -7 0 7 14 21 28 35 42 °F

−24 −20 −16 −12 −8 −4 0 4 8 12 16 20 24 °C

http://www.wunderground.com/blog/JeffMasters/comment.html?entrynum=2027

Rome, January 2012

http://www.ndtv.com/album/listing/news/europe-cold-wave-snow-blankets-countries-in-wintry-landscape-12283

Pensioner Raisa Pochekovskaya, 73, puts firewood into her cast-iron wood stove in the village of Kolodishchi, on the outskirts of Minsk, Belarus. The Belarussian militia have been visiting the elderly and single residents of the village to provide assistance during Eastern Europe's severe cold spell. (Vasily Fedosenko/Reuters)

Climate change alters the environment in complex ways. The Andes, warming for decades, has seen *three bitter winters* that have left more than 400 dead and aid agencies scrambling. *

"This cold is too much with us"
Carlos Cruz Chantos, farmer

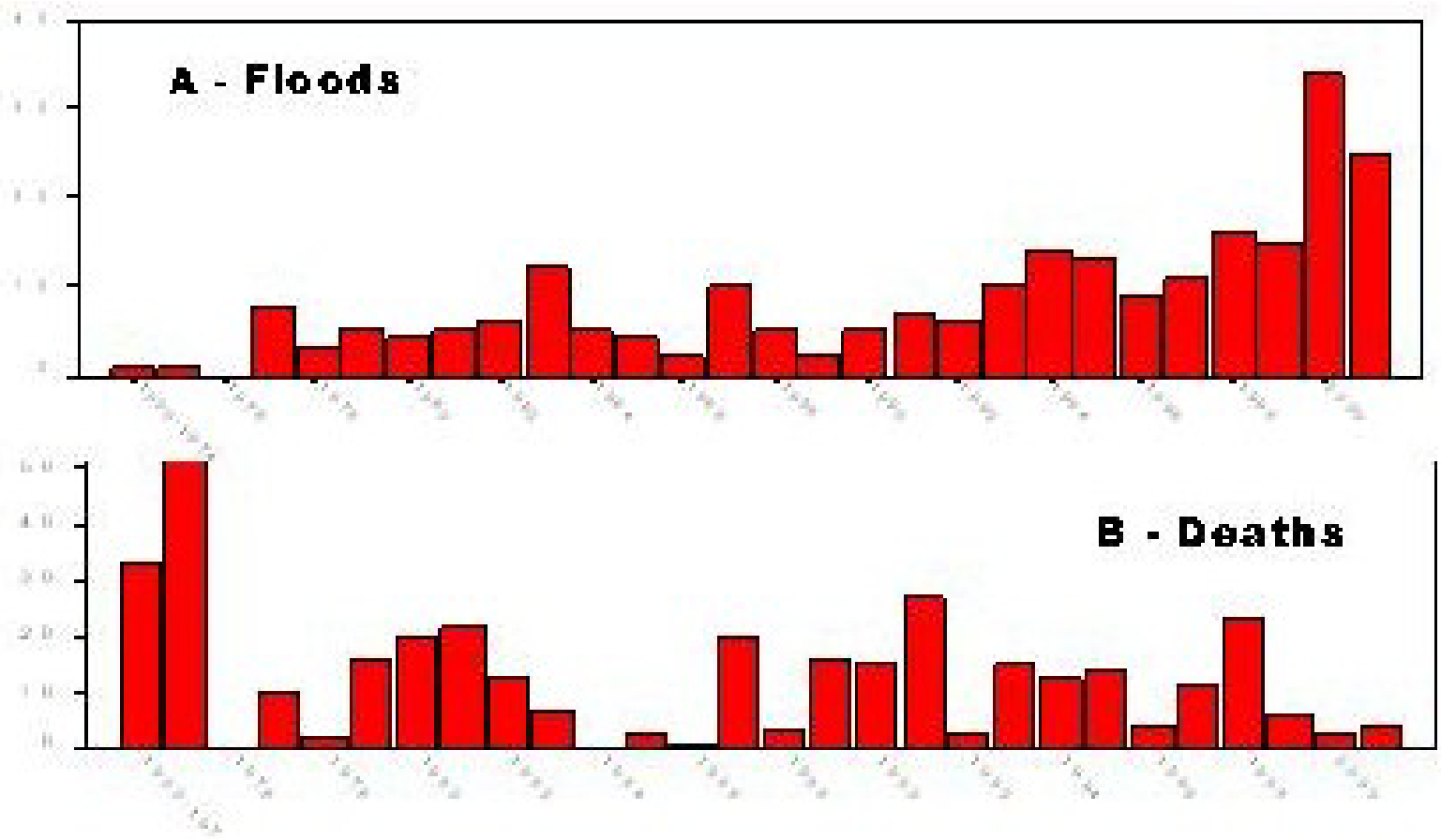
*The Daily Climate. 13 Feb 2012.

health impacts of floods

flooding: CANVEY ISLAND, UK 1953

sunken marsh ("Danger Area") where 53 of the 58 flood victims died

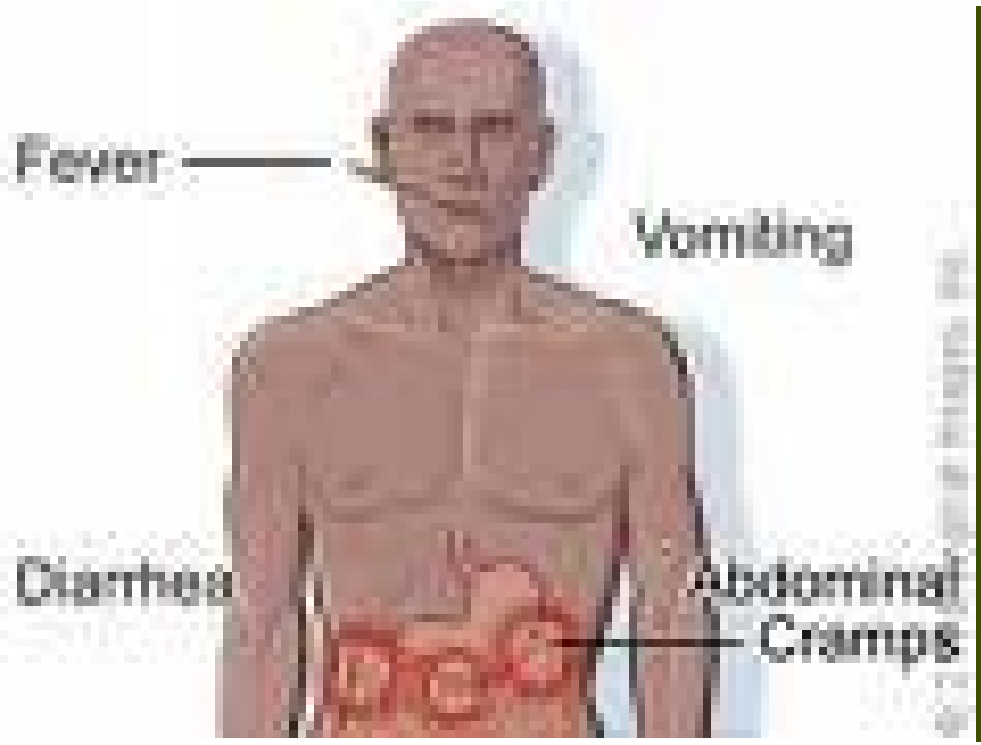
number of floods (A) and flood-related mortality (B) Europe: 1974-2000

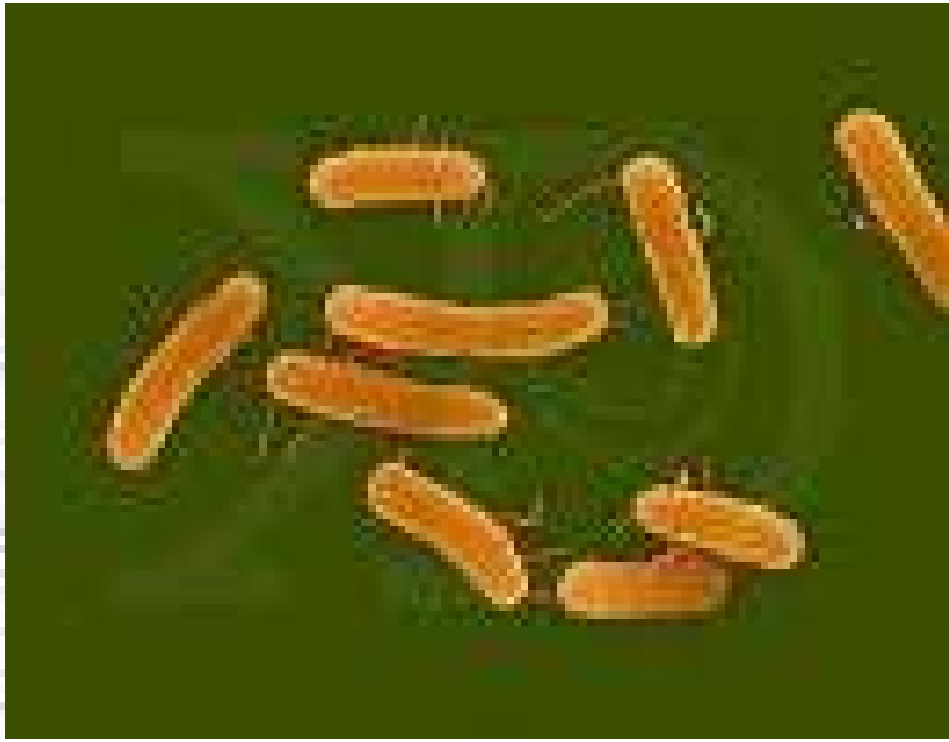


Source: World Health Organisation, 2002

fhrc

infectious diseases and climate change





reported Salmonellosis *versus* recent temperature, UK (Kovats, 2004)

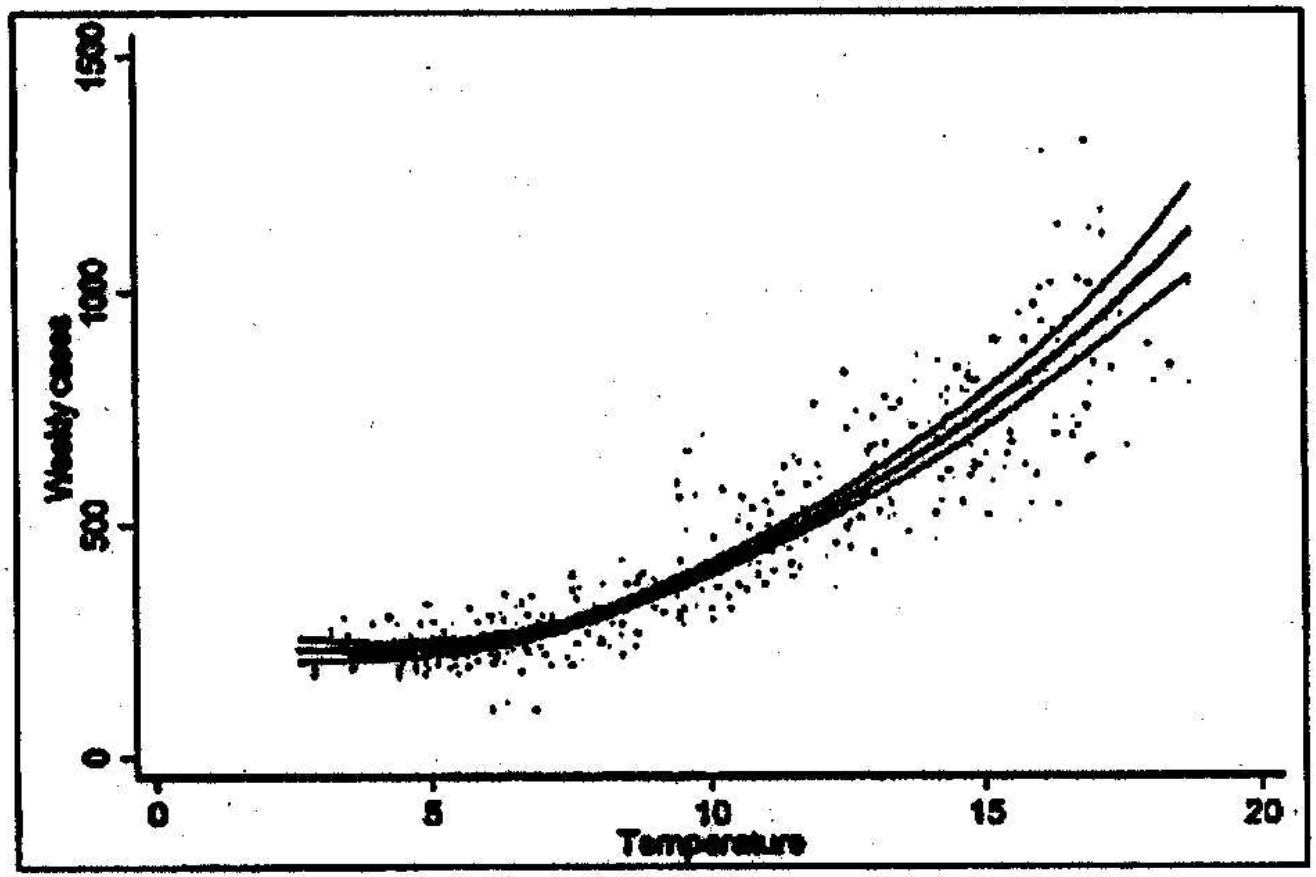
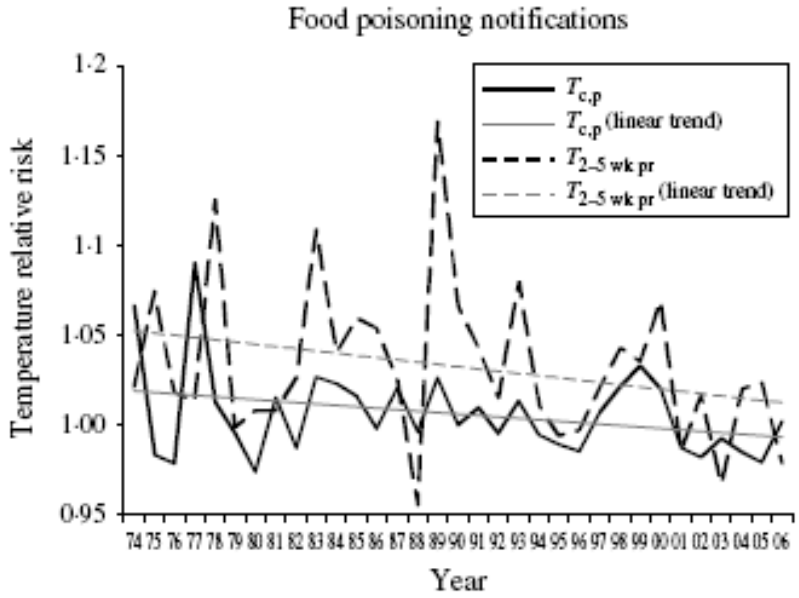
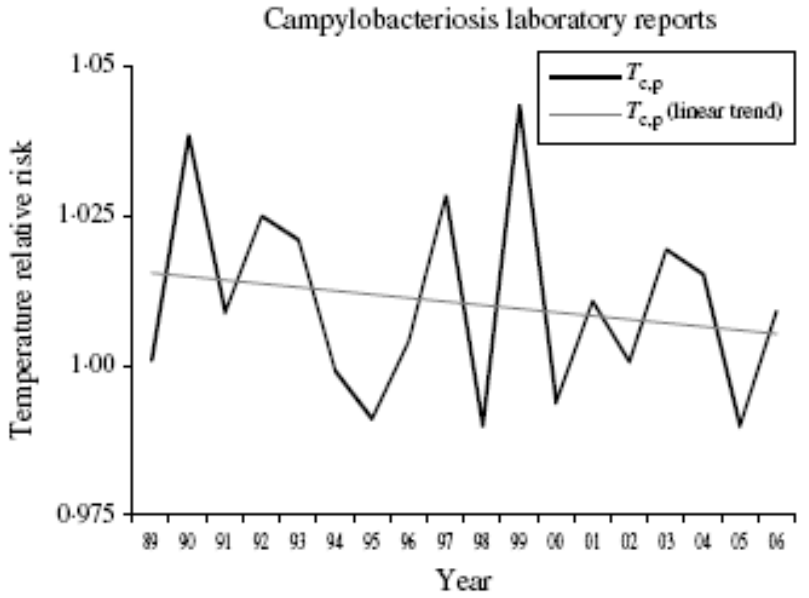
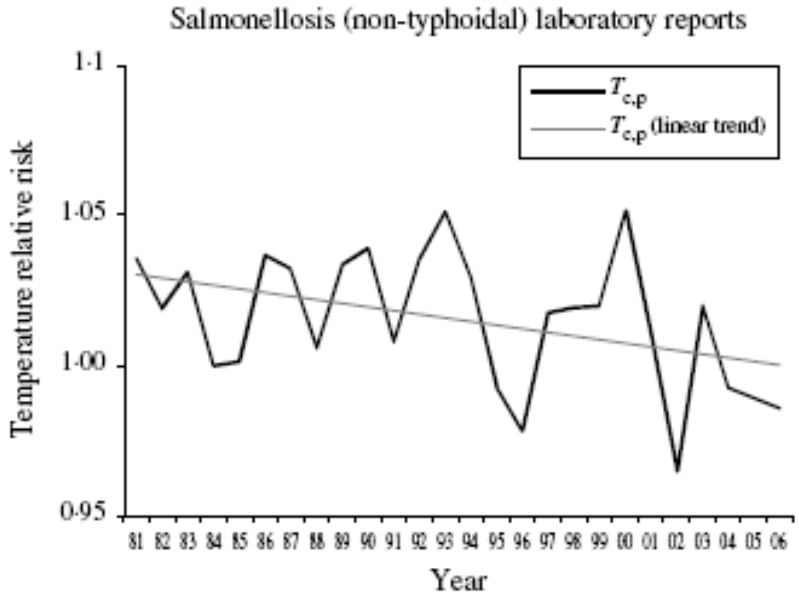
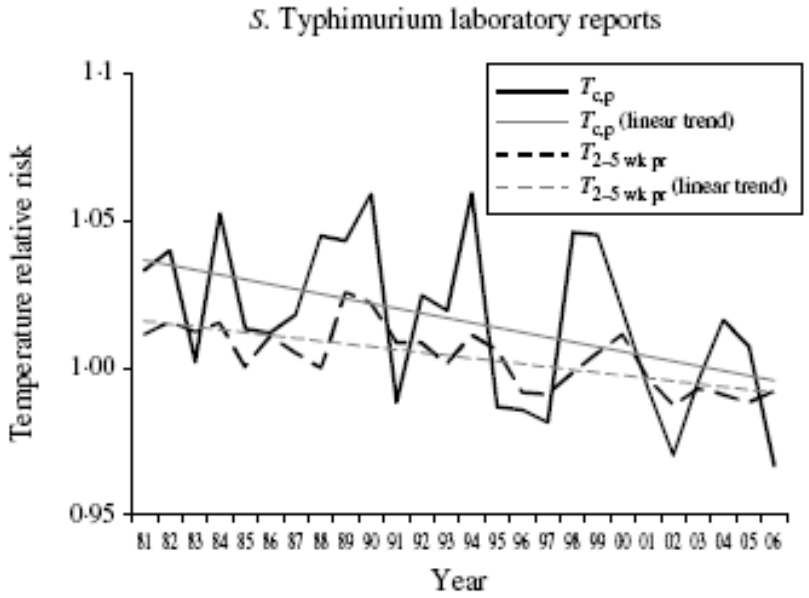


Figure 1. The crude relationship between report cases of salmonella and temperature (°C) in previous nine weeks in England and Wales.


Food poisoning notifications
Temperature relative risk
1·2
1·15
1·1
1·05
1·00
0·95
$T_{c,p}$
$T_{c,p}$ (linear trend)
$T_{2–5\ wk\ pr}$
$T_{2–5\ wk\ pr}$ (linear trend)
74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05 06
Year

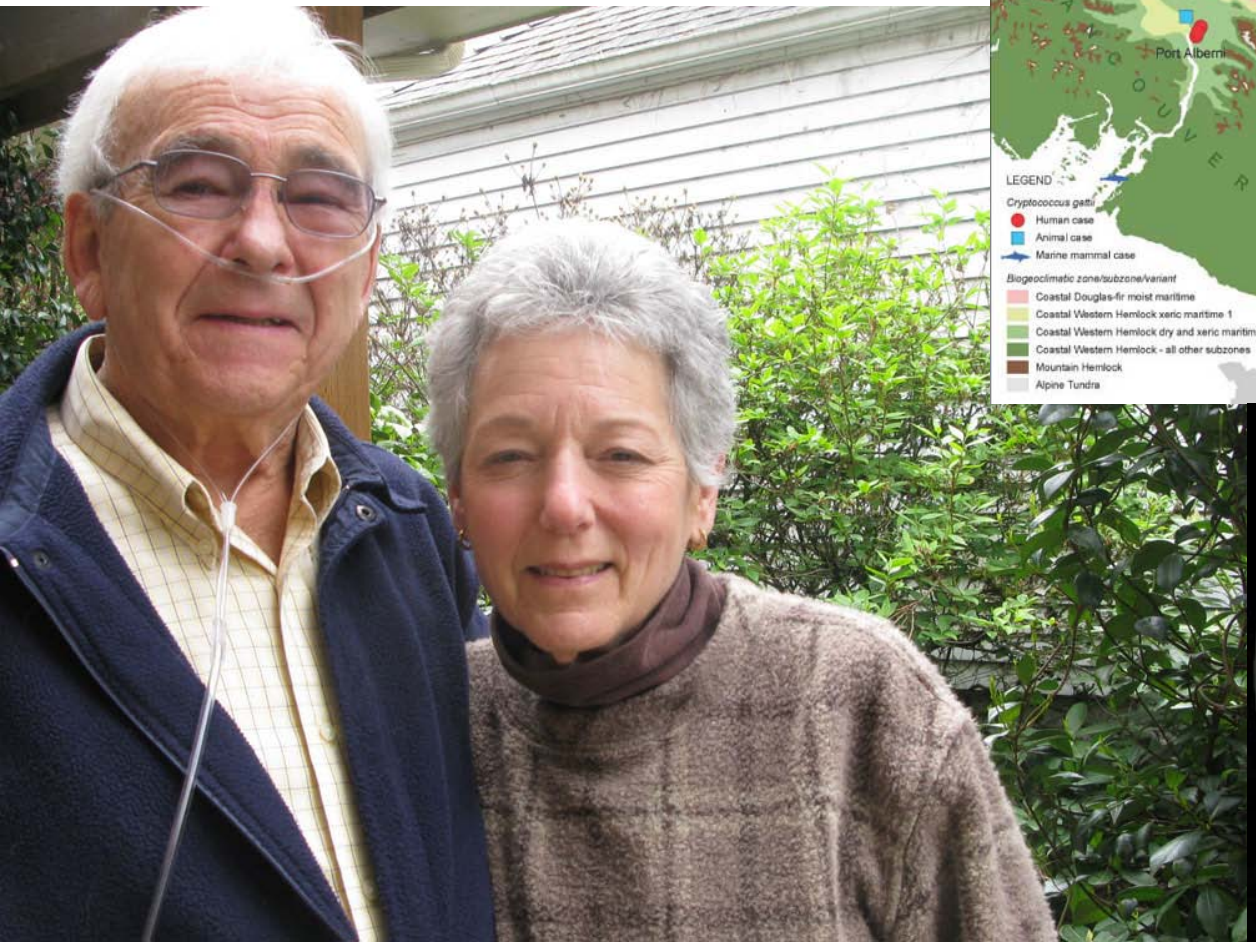

Campylobacteriosis laboratory reports
Temperature relative risk
1·05
1·025
1·00
0·975
$T_{c,p}$
$T_{c,p}$ (linear trend)
89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05 06
Year

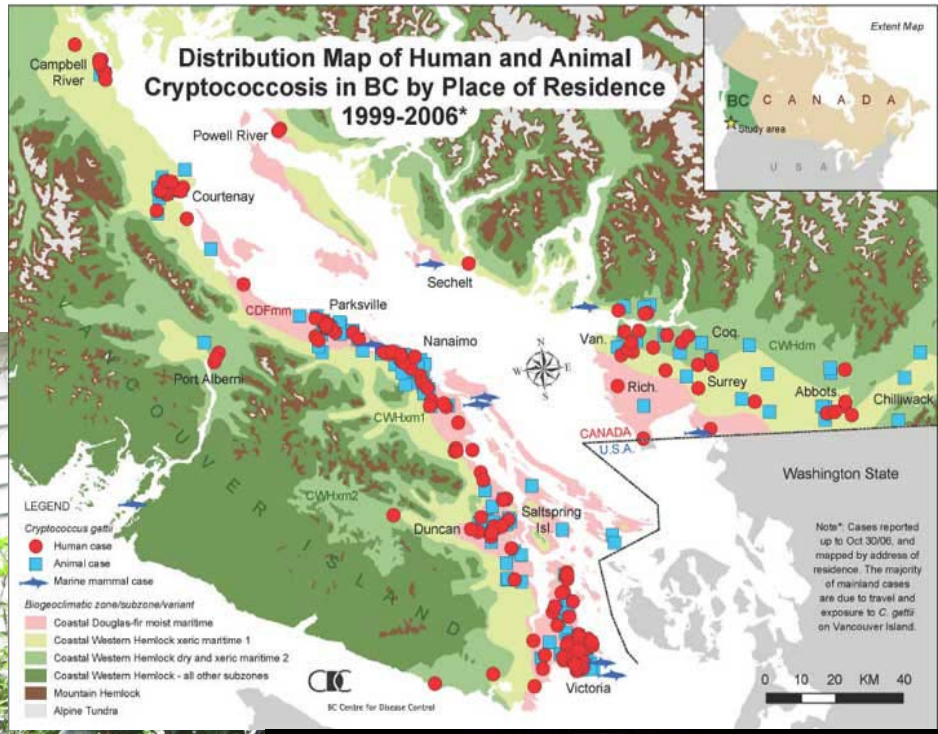

Salmonellosis (non-typhoidal) laboratory reports
Temperature relative risk
1·1
1·05
1·00
0·95
$T_{c,p}$
$T_{c,p}$ (linear trend)
81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05 06
Year


S. Typhimurium laboratory reports
Temperature relative risk
1·1
1·05
1·00
0·95
$T_{c,p}$
$T_{c,p}$ (linear trend)
$T_{2–5\ wk\ pr}$
$T_{2–5\ wk\ pr}$ (linear trend)
81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05 06
Year

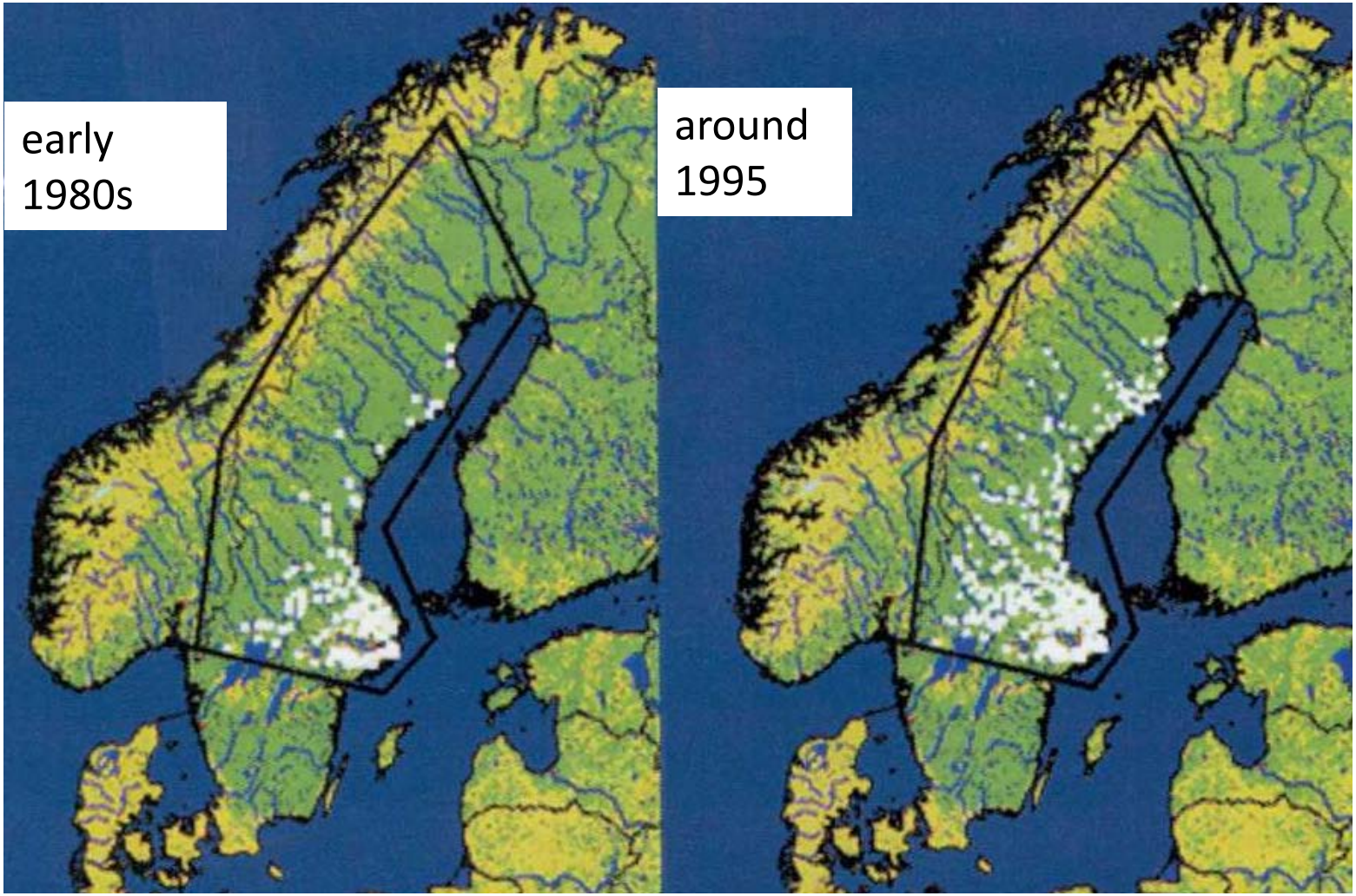
Lake, 2009

climate change & infectious disease: is the future here?





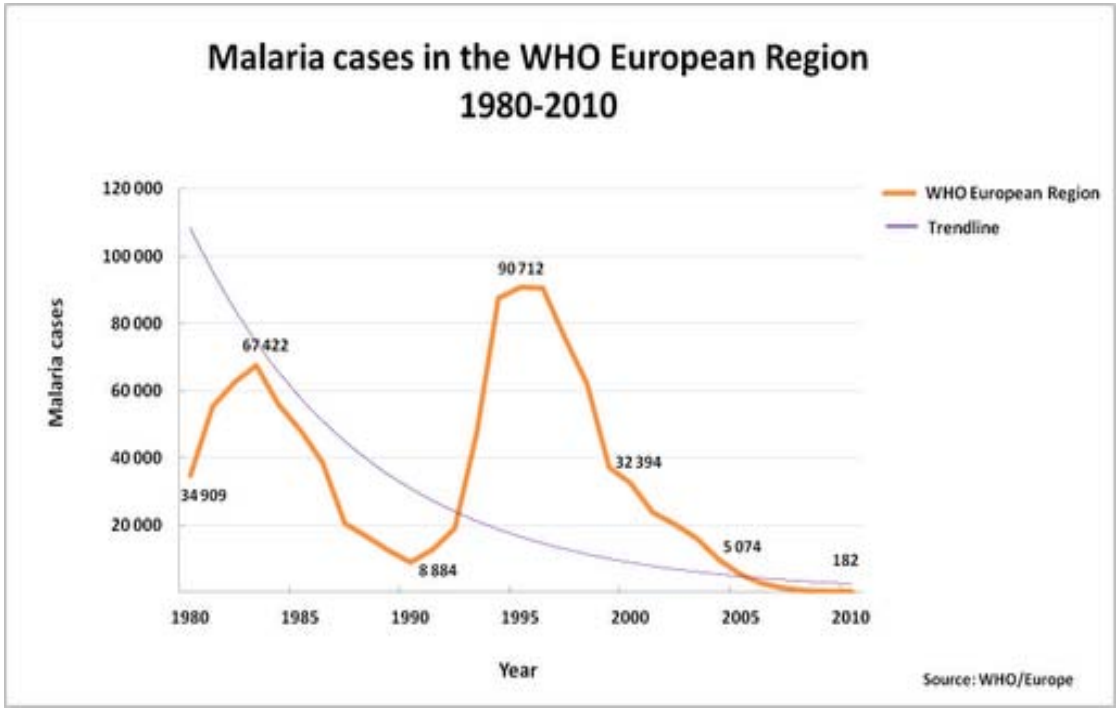
tick-bourne encephalitis, Sweden 1980s *versus* 1990s: winter warming?



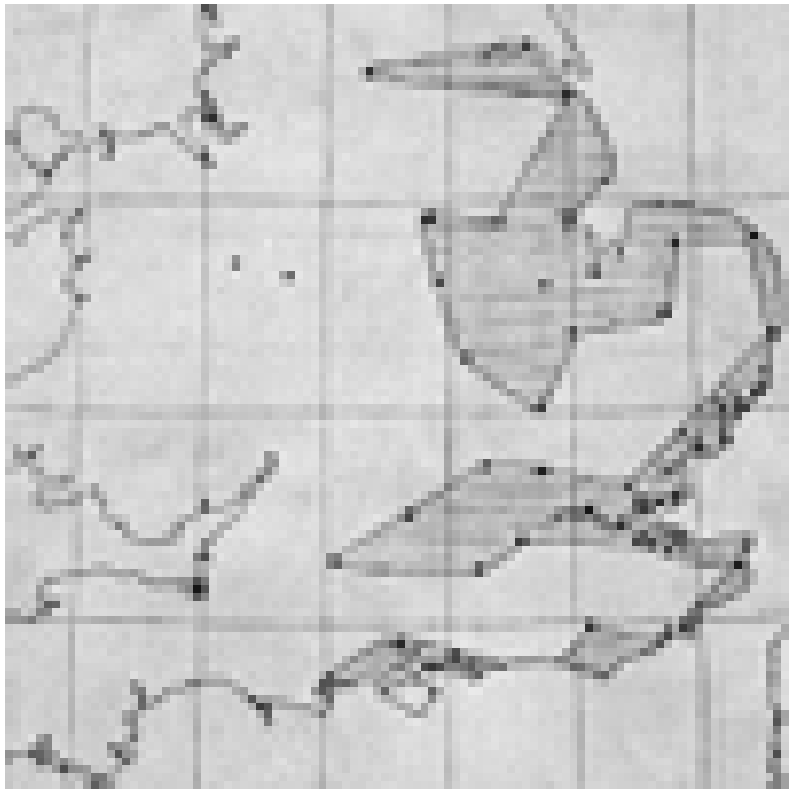
Reported tick locations (Lindgren , 2000)

is Europe ripe for malaria?

Malaria in Europe—
a climate change signal?



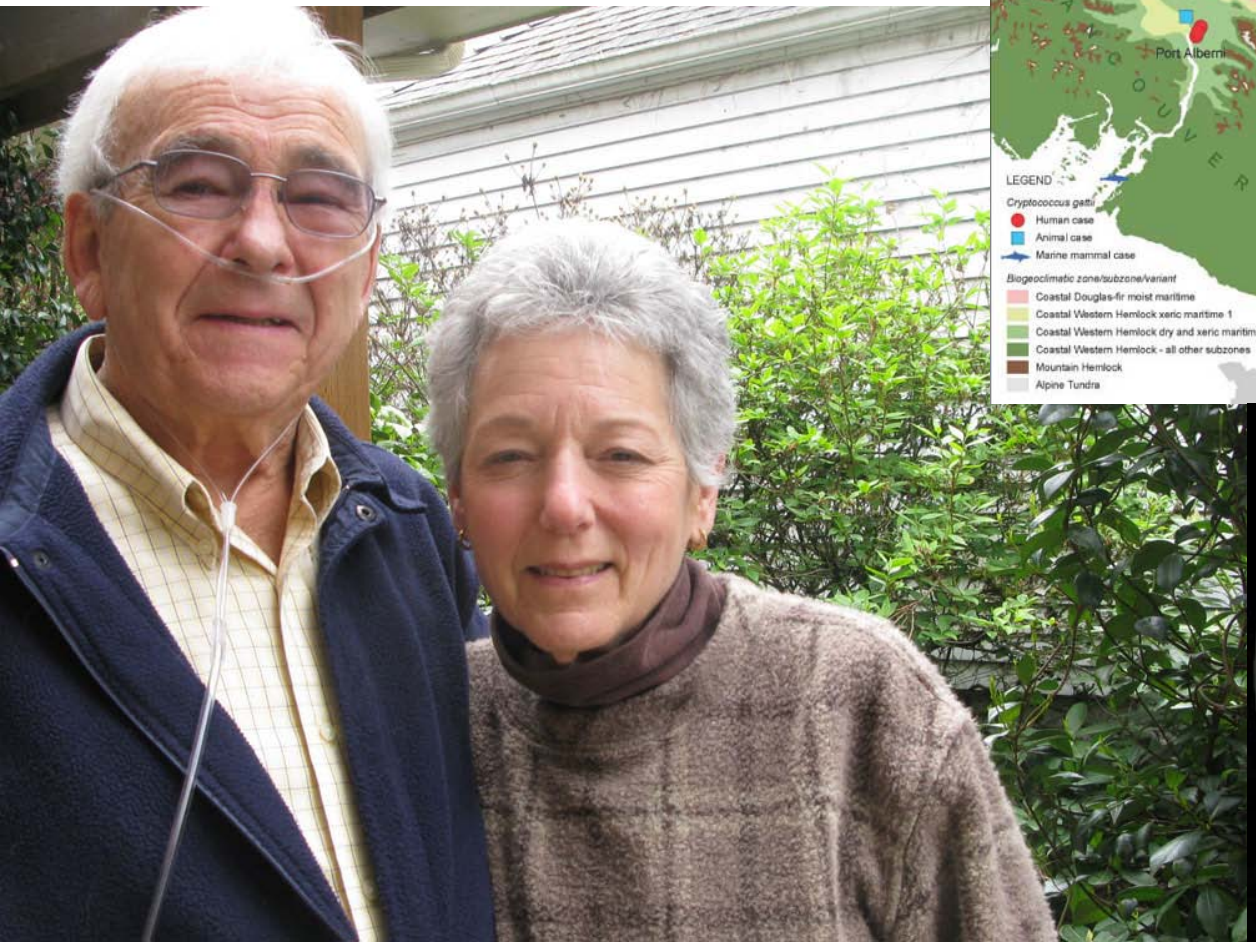
malaria in England may date back to Roman times, and outbreaks even occurred after the First World War

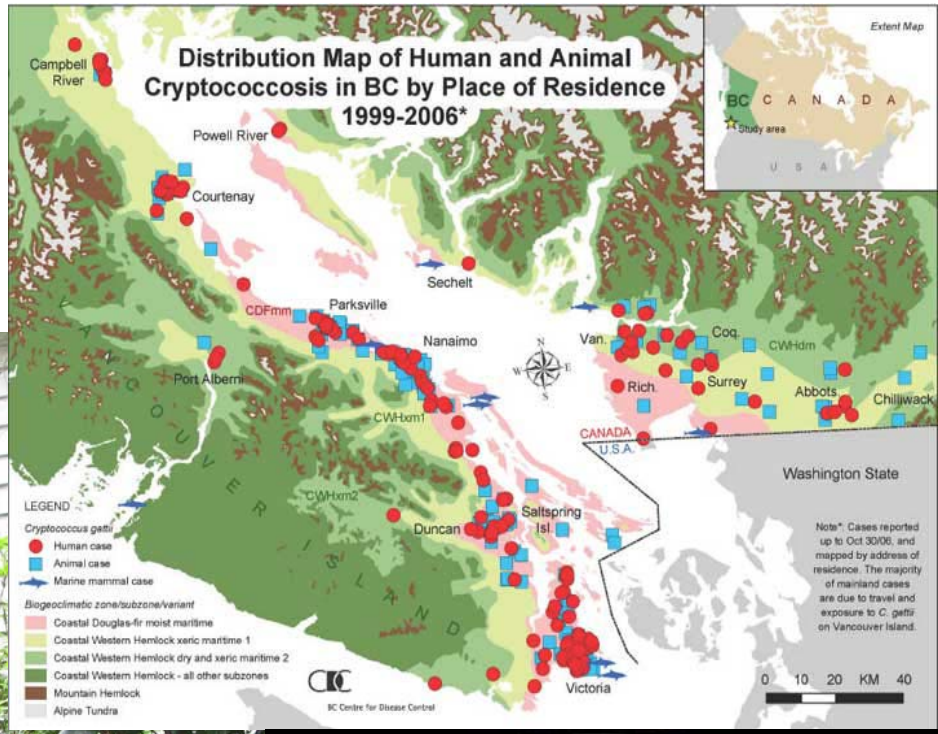


Dobson,1999

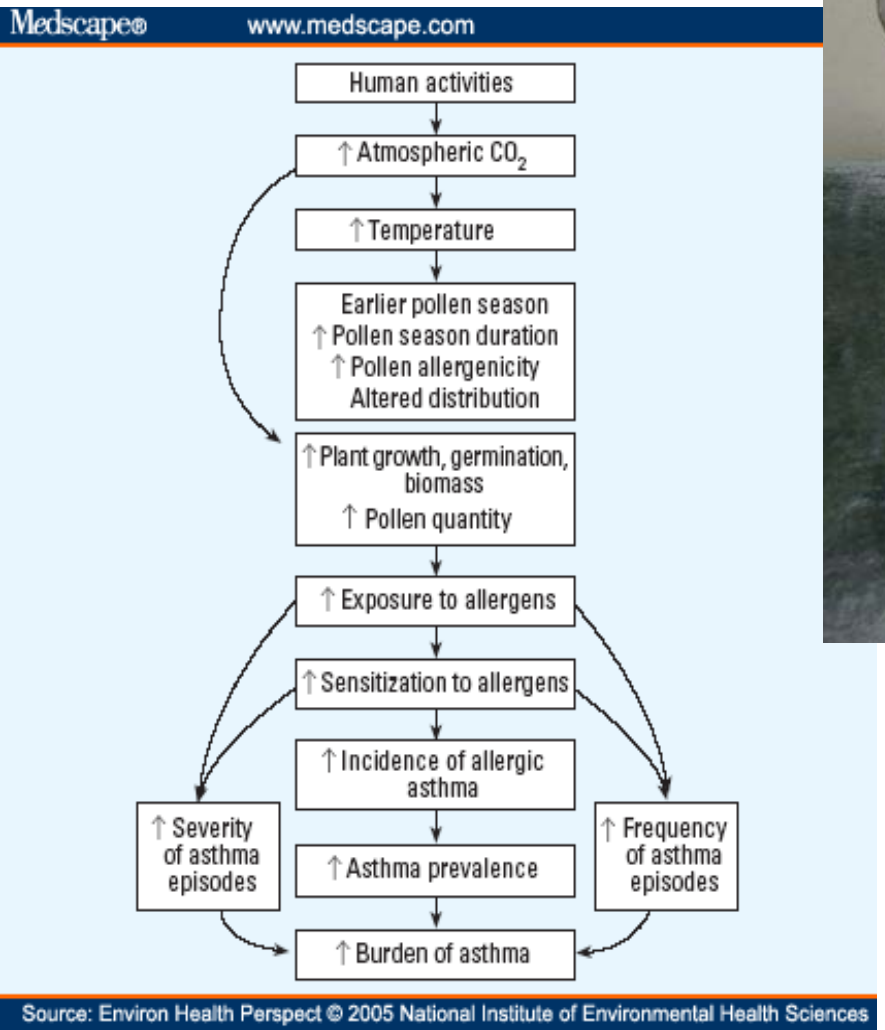
DeBess (Oregon epidemiologist) was careful to put the Northwest's ***C. gattii*** outbreak in perspective. Only 60 cases have been detected over nearly six years in two or three states.

Meanwhile 36,000 people die annually in the United States from ***influenza***.





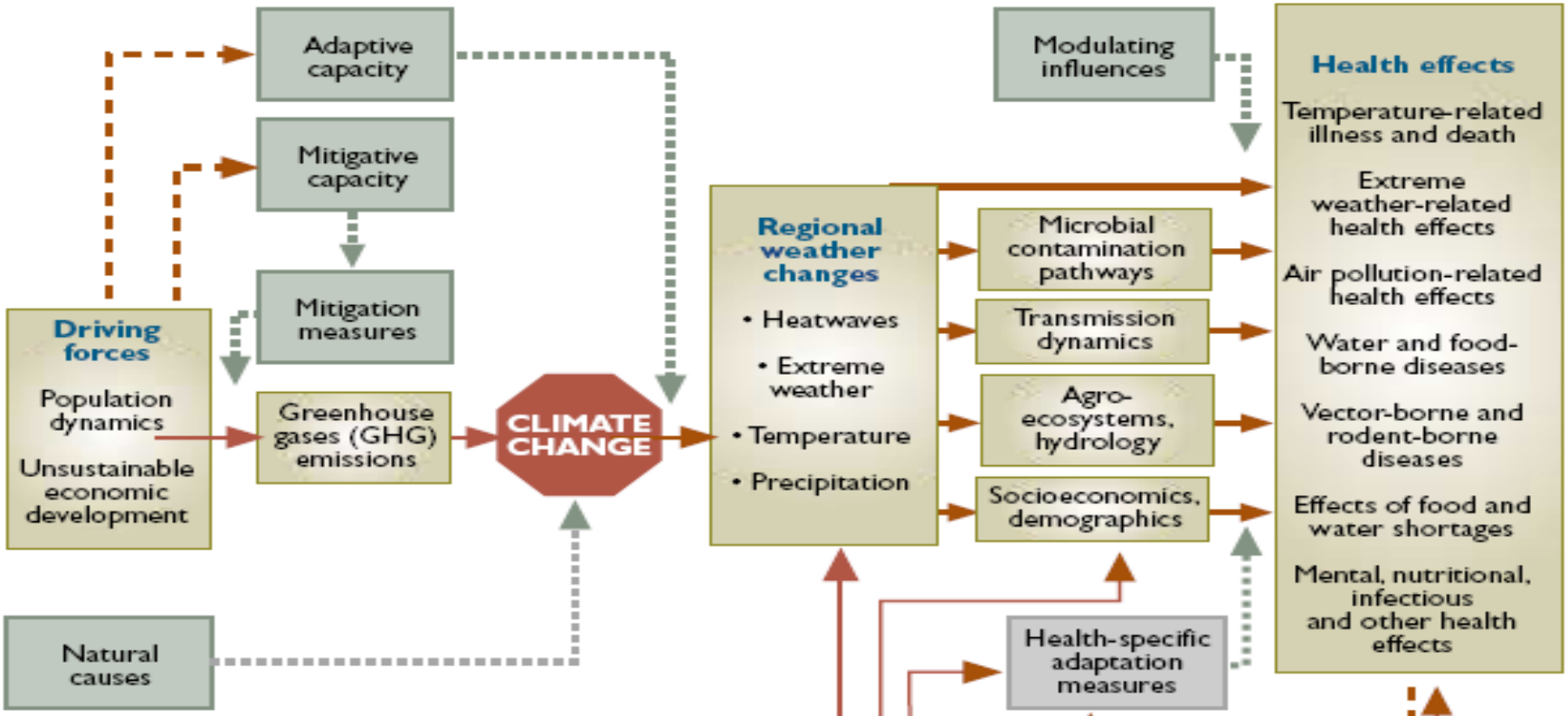
climate change to worsen childhood asthma?



Why is British Columbia in the midst of a mountain pine beetle epidemic?

Forests of mature lodgepole pine are prime habitat for the mountain pine beetle. The beetle also thrives under warm weather conditions. The interior of British Columbia has an abundance of mature lodgepole pine, and has experienced several consecutive mild winters and drought-like summers. Beetle populations in many parts of interior B.C. have increased to epidemic levels as a result.

Figure 13.1. Climate change and health: pathway from driving forces, through exposures to potential health impacts. Arrows under research needs represent input required by the health sector. (Modified from reference 4)



drivers

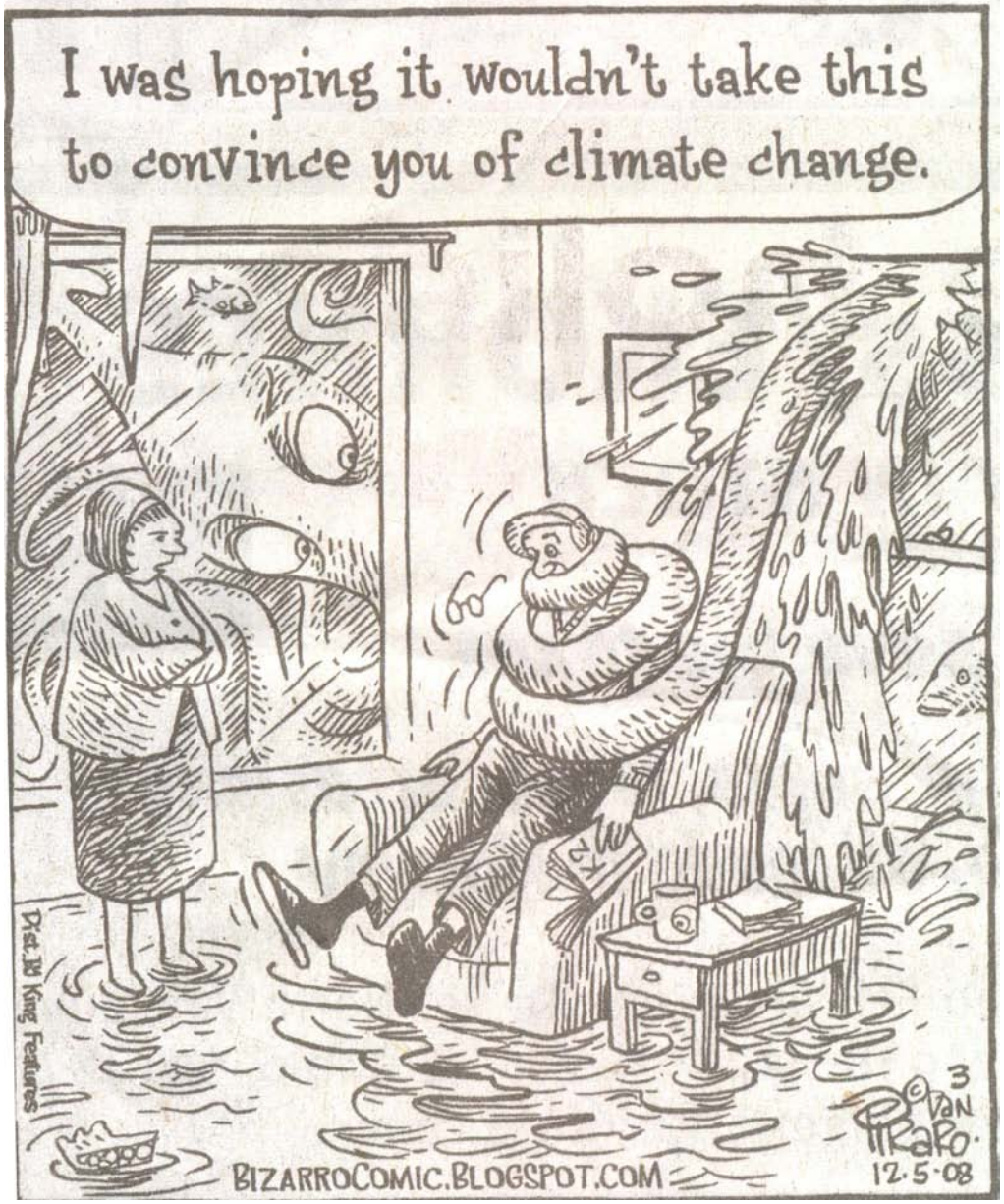
super-drivers

weather disruptions

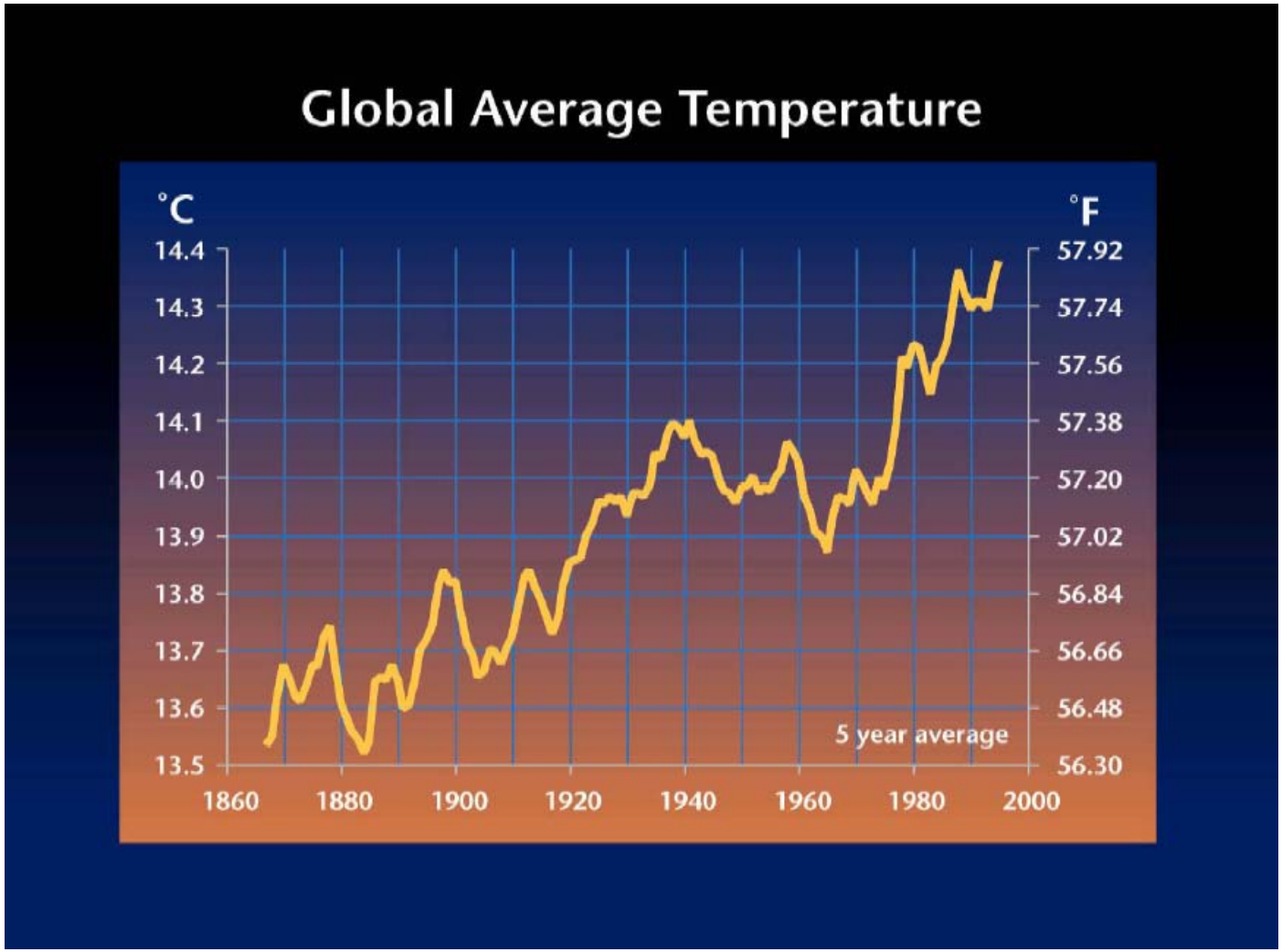
eco-stressors

health effects

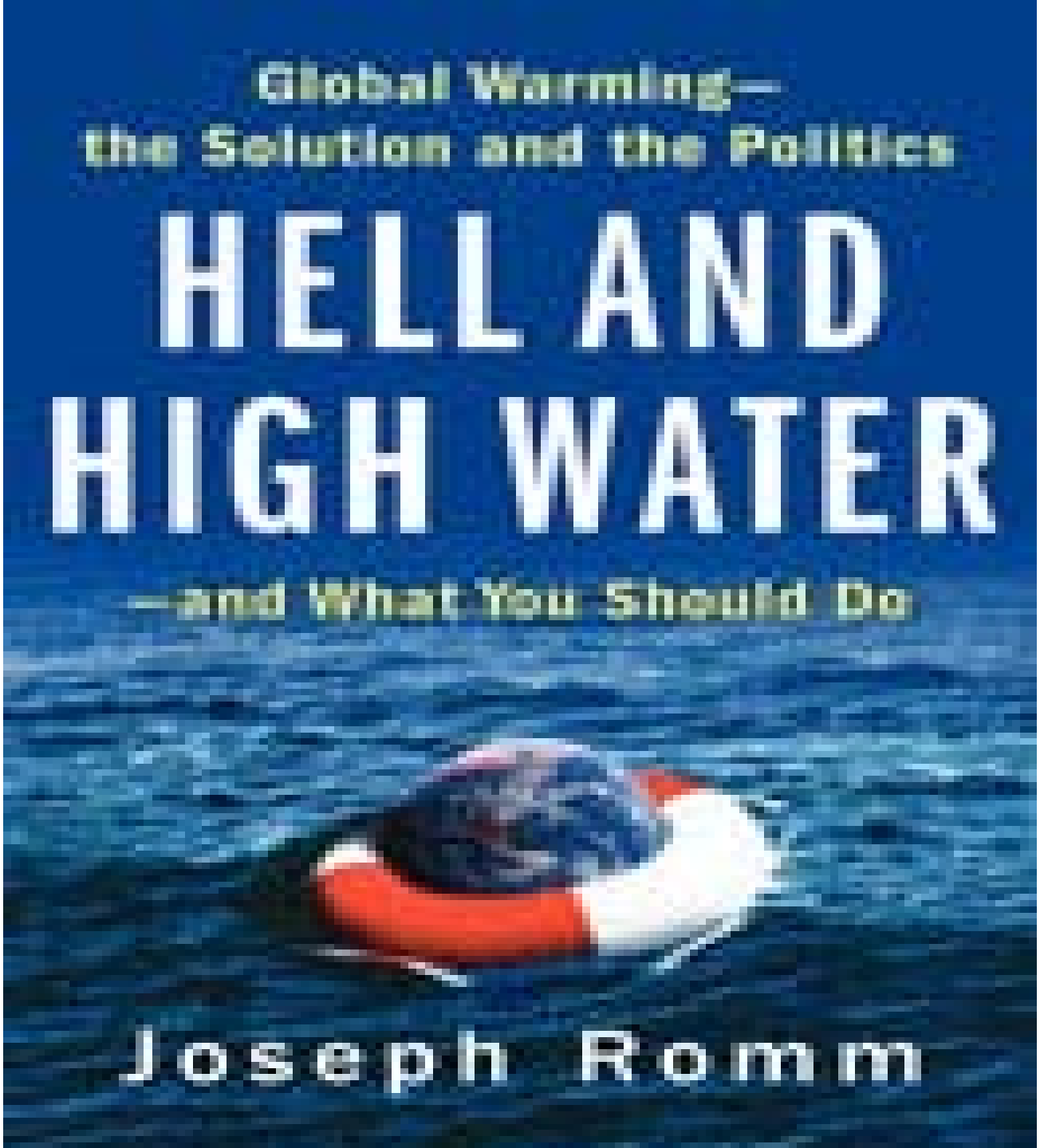
BIZARRO


I was hoping it wouldn't take this to convince you of climate change.
Dist. by King Features
BIZARROCOMIC.BLOGSPOT.COM
3
DAN PIRARO
12-5-08

while industrialized society has adapted to this

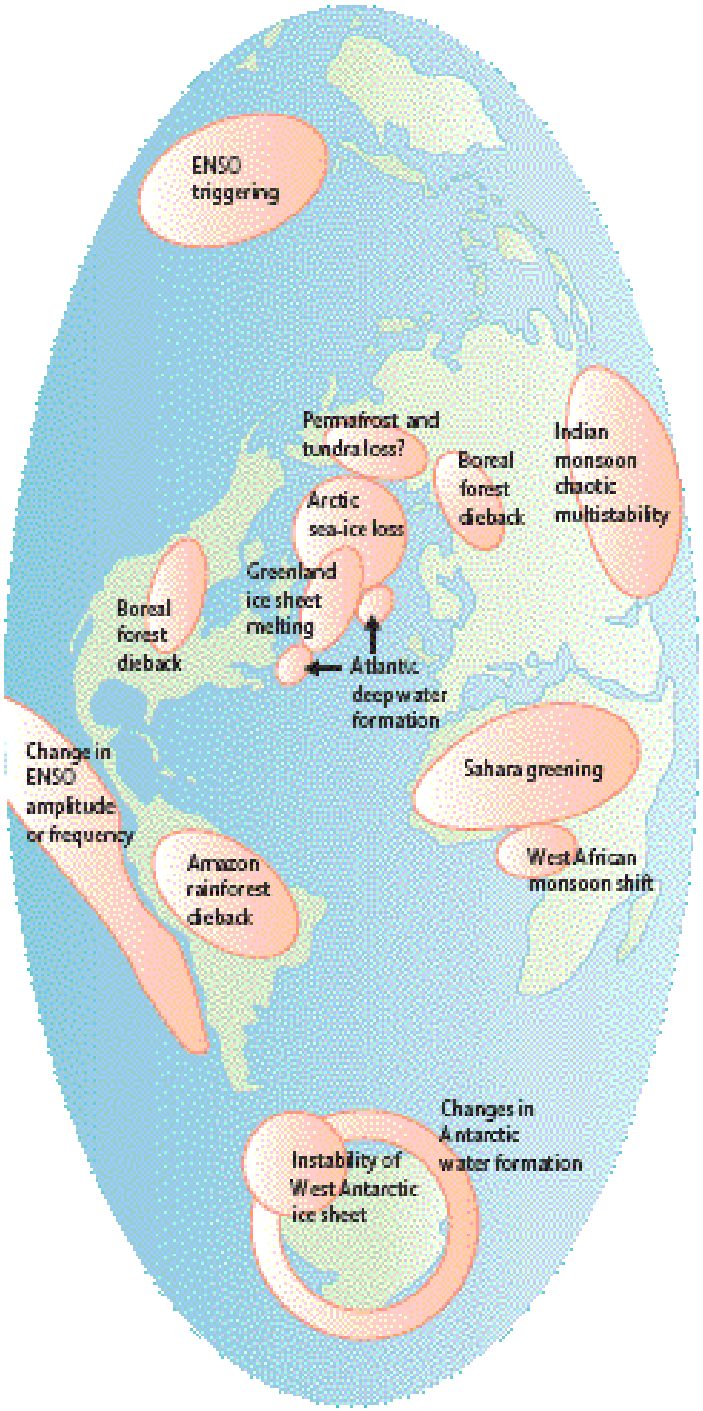


there are limits to adaptive capacity



how will we adapt to this?

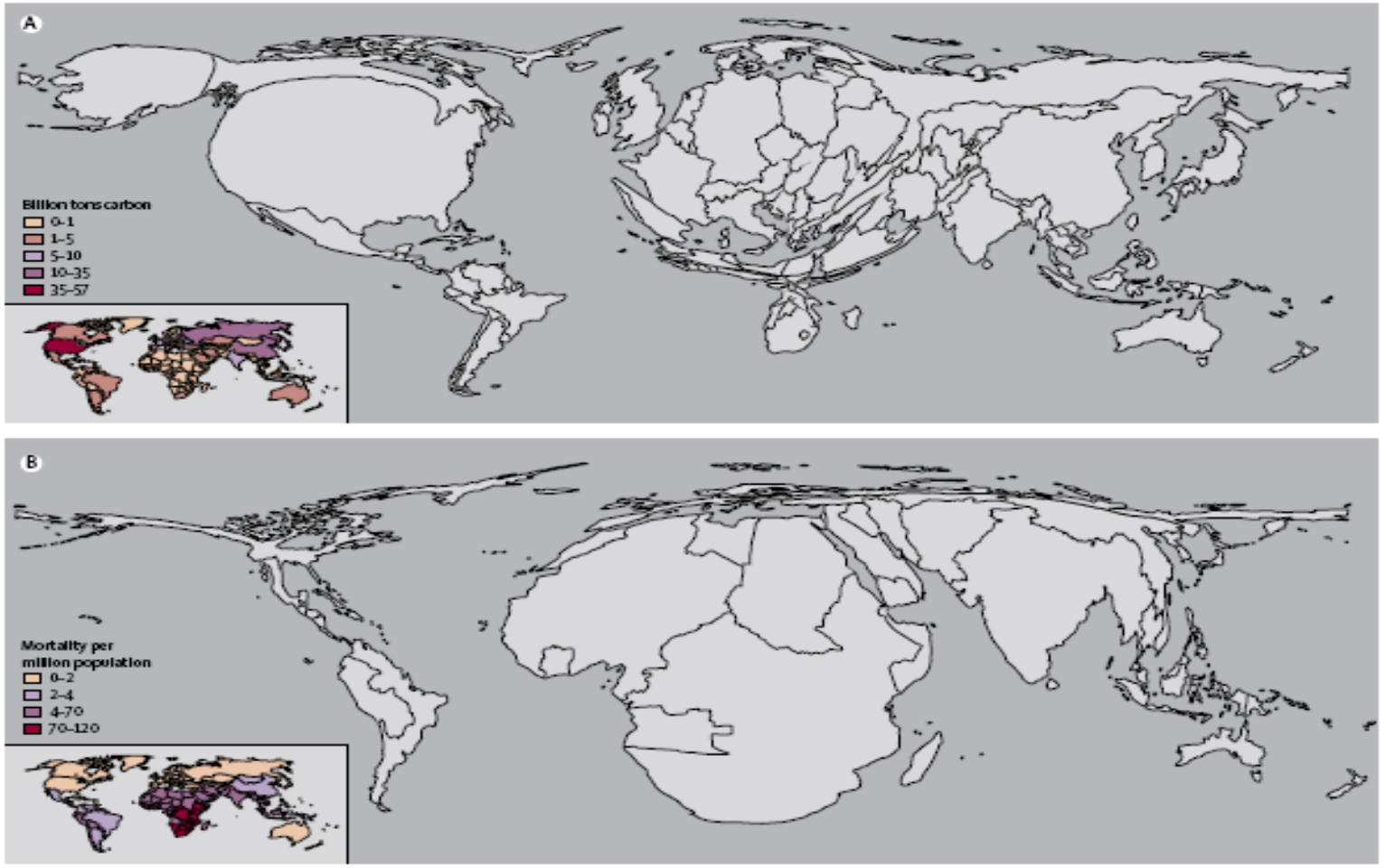
potential
tipping points
in climate
systems



ENSO=El Nino southern oscillation. Boreal forest is the most northern woodland area. Tundra is a vast, mostly flat, treeless Arctic region of Europe, Asia, and North America in which the subsoil is permanently frozen.

mass migration as a consequence of climate change

greenhouse gas producers (top), climate change **victims** (bottom)



WHO, 2004

effectiveness of public health and public policy in adapting to climate change in industrialized countries

1. climate change is one of many core risks to health
2. situational, ecologic, behavioural, and organisational factors modify climate/health relationships dynamically, and often in ways hard to foresee.
3. despite global warming, and despite increasing numbers of events in industrialised countries, on aggregate, the frequency of severe insults to health of extreme weather has declined
4. so far, in the industrial world, relatively modest, targeted public health campaigns (most often carried out for other reasons) have been effective in limiting climate change-linked impacts

effectiveness of public health and public policy in adapting to climate change in industrialized countries

5. such has not been the case in the South, where inequity combined with ineffectiveness have led to high levels of climate-change induced disease
6. this inequity threatens the industrial world through the spill-over of vectors, agents and populations
7. tipping points present a break beyond the known

lessons for Canadian public health officials

- conventional public health tools can mitigate much of the health risk of climate change
- public health must promote adaptive approaches that are multi-disciplinary, and broadly acceptable
- ongoing assessment is key to optimize adaptation
- we need to share adaptation examples and strategies
- public health alone won't save the dinosaurs

Tom Kosatsky
EHS & NCCEH, BCCDC
Regina February, 2012
tom.kosatsky@bccdc.ca