

Health Co-benefits from Climate Change Mitigation Policies

**Aspen Global Change Institute
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HEALTH EFFECTS OF CLIMATE CHANGE

CLIMATE CHANGE

*Temperature Rise*¹

*Sea level Rise*²

Hydrologic Extremes

¹ 3° C by yr. 2100

² 40 cm “ “

IPCC estimates

HTN and Preeclampsia

Urban Heat Island Effect

Air Pollution & Aeroallergens

Vector-borne Diseases

Water-borne Diseases

Water resources & food supply

Mental Health &

Environmental Refugees

→ Heat Stress
Cardiorespiratory failure

→ Respiratory diseases, e.g.,
COPD & Asthma

Malaria
Dengue
Encephalitis
Hantavirus
Rift Valley Fever

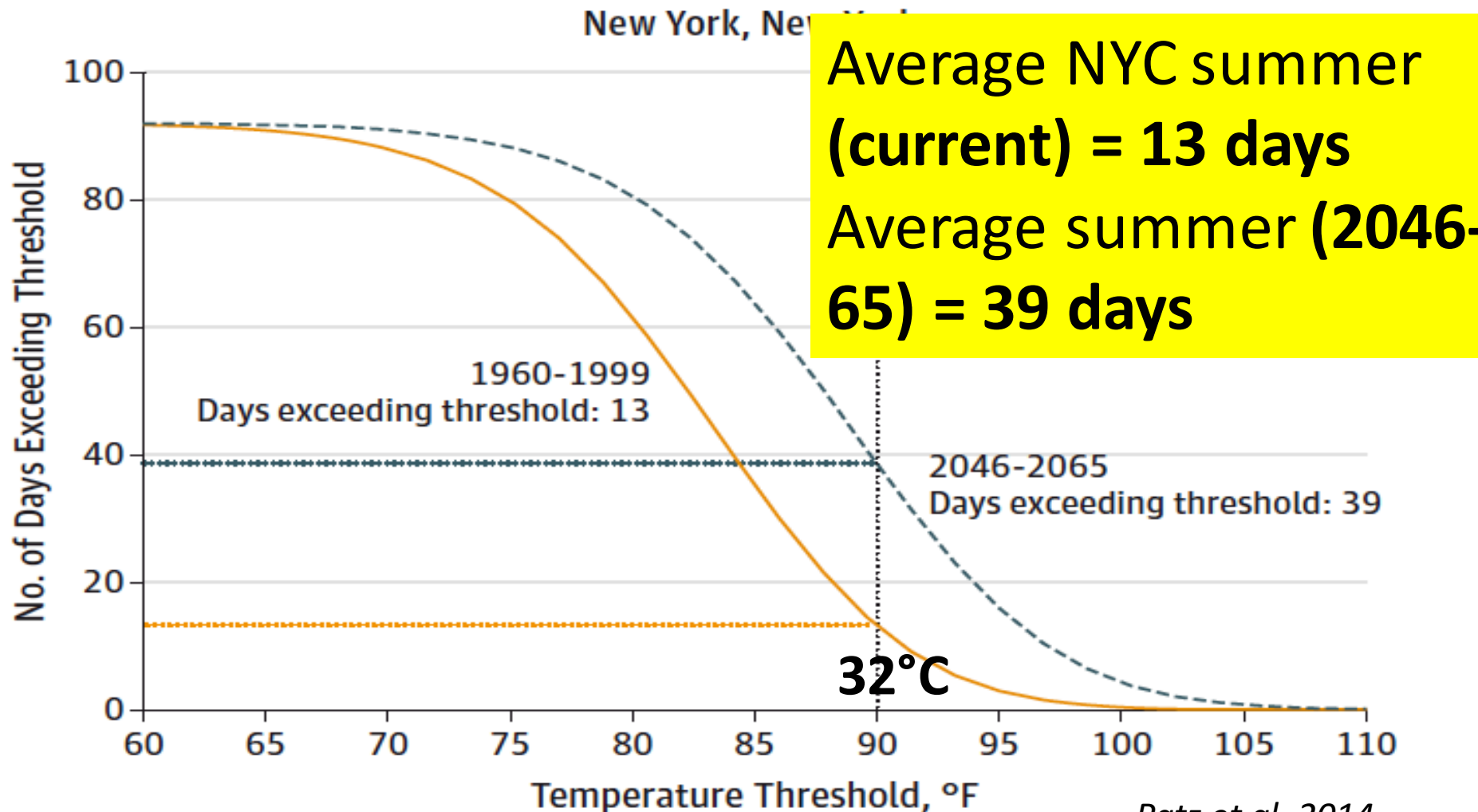
Cholera
Cyclospora
Cryptosporidiosis
Campylobacter
Leptospirosis

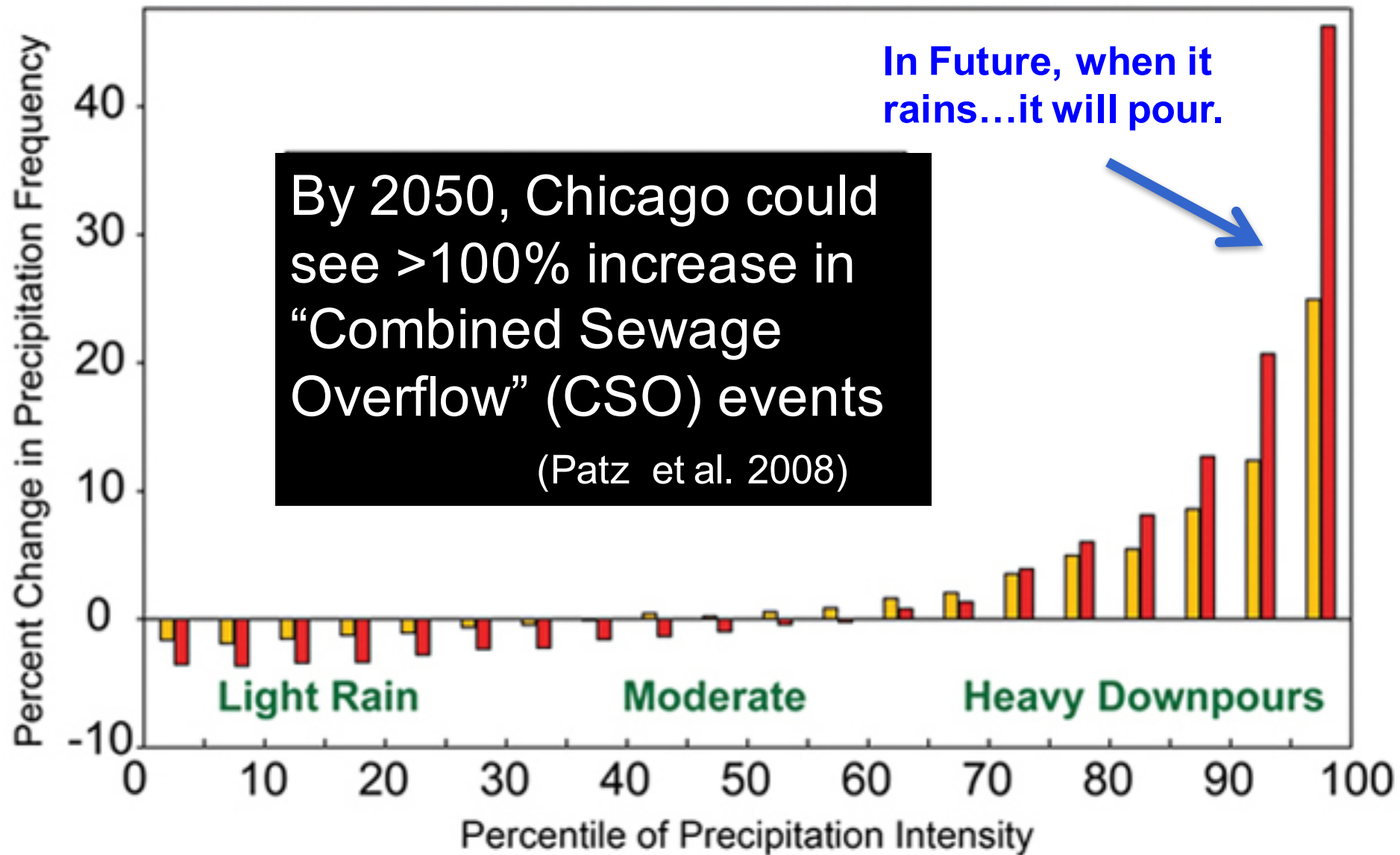
→ Malnutrition
Diarrhea
Toxic Red Tides

→ Forced Migration
Overcrowding
Infectious diseases
Human Conflicts

Patz, 1998

Future heat in the US

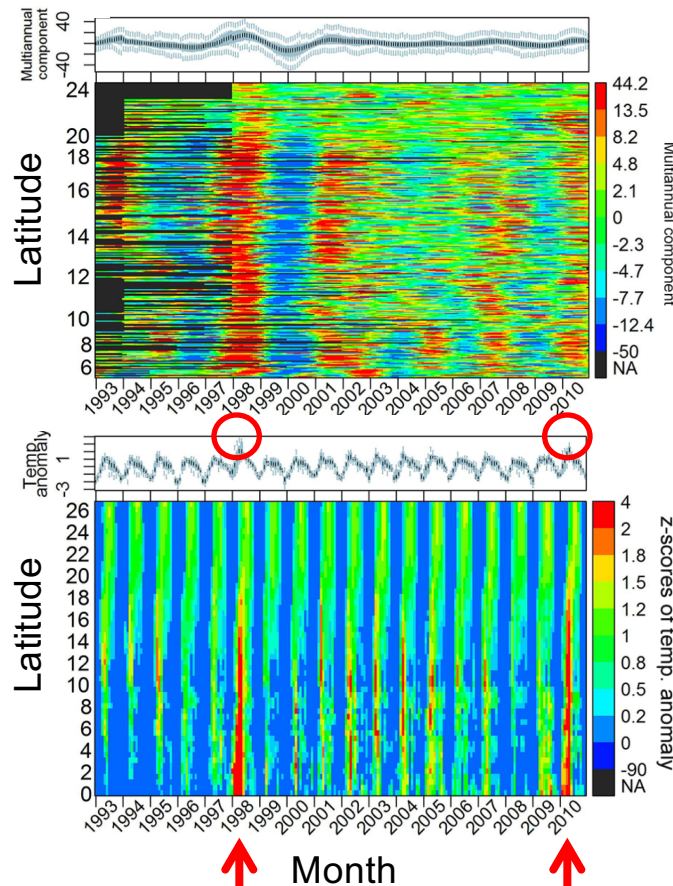




Globally Averaged

U.S. CCSP, 2008

Synchrony during high temperature for SE Asia (18 years of data)

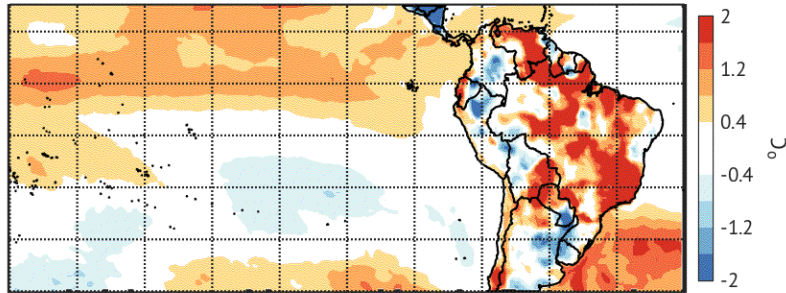


***Synchronous
Multiannual dengue cycles***

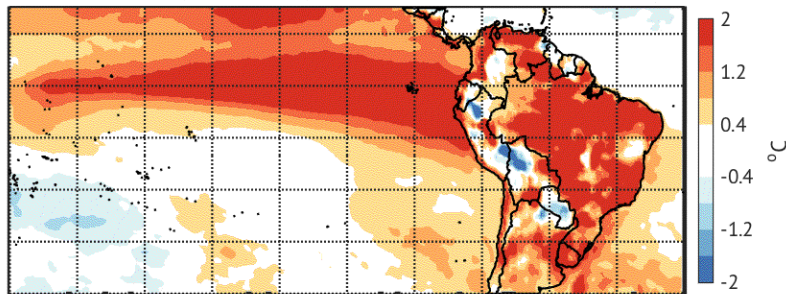
**Temperature anomaly
(Average lag time ~ 3 to 4 months
for log growth phase)**

van Panhuis et al. PNAS, 2015

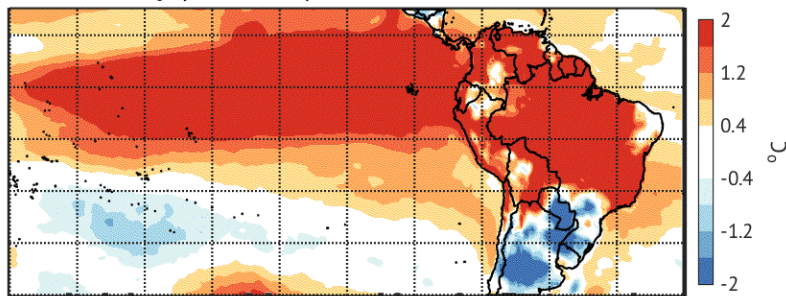
Surface Temp (2m TMAX): OCT 2014 - MAR 2015



Surface Temp (2m TMAX): APR 2015 - SEP 2015



Surface Temp (2m TMAX): OCT 2015 - FEB 2016

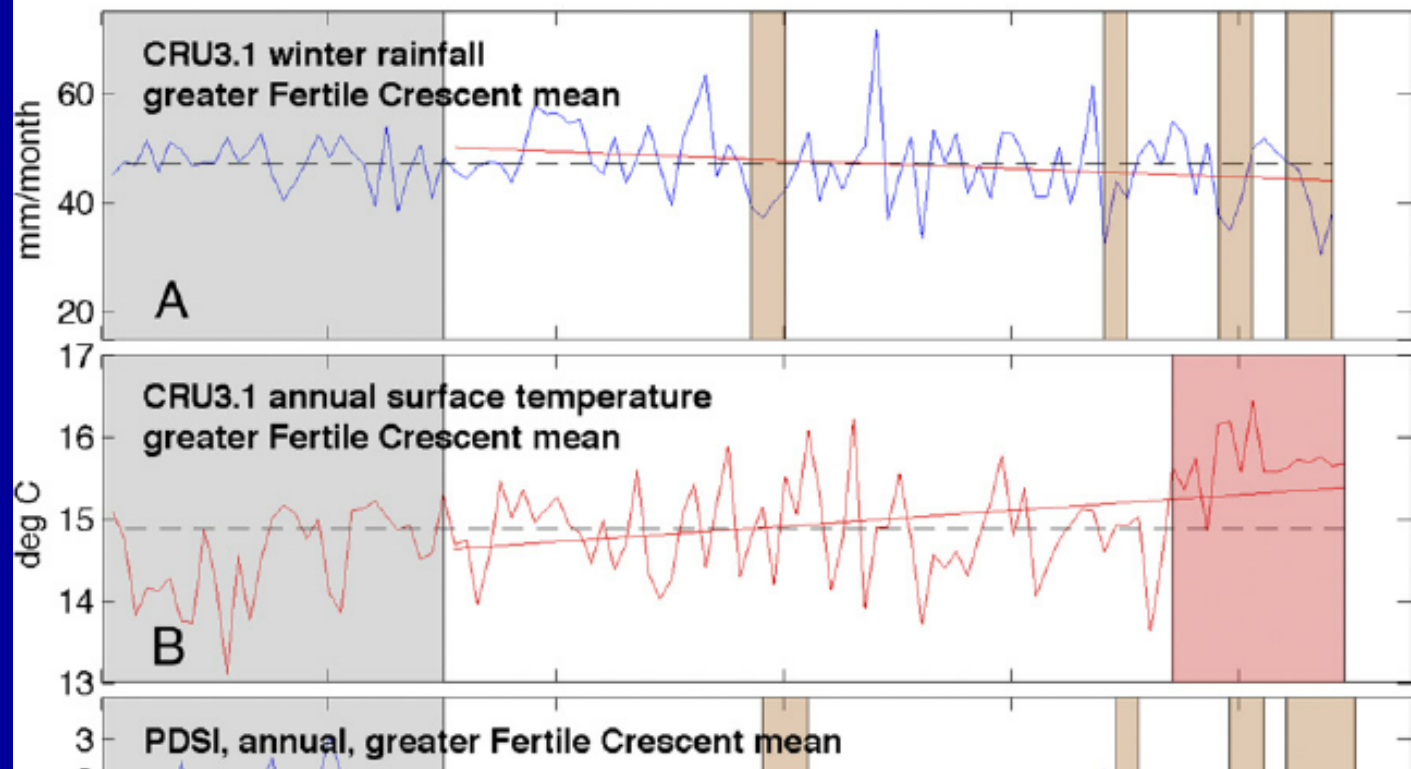


El Niño of 2015
may be the strongest in the
recent hisorical record,
surpassing the 1997-98
event

Patz, Vimont et al, **IN PREPARATION**

Syria

Precipitation
tends



“Most severe drought in the
instrumental record.”

Kelly et al. PNAS, 2015

Civil War > 400,000 dead & 9 million refugees



Took place Nov. 30 – Dec. 11, 2015 in Paris, France

Historic meeting

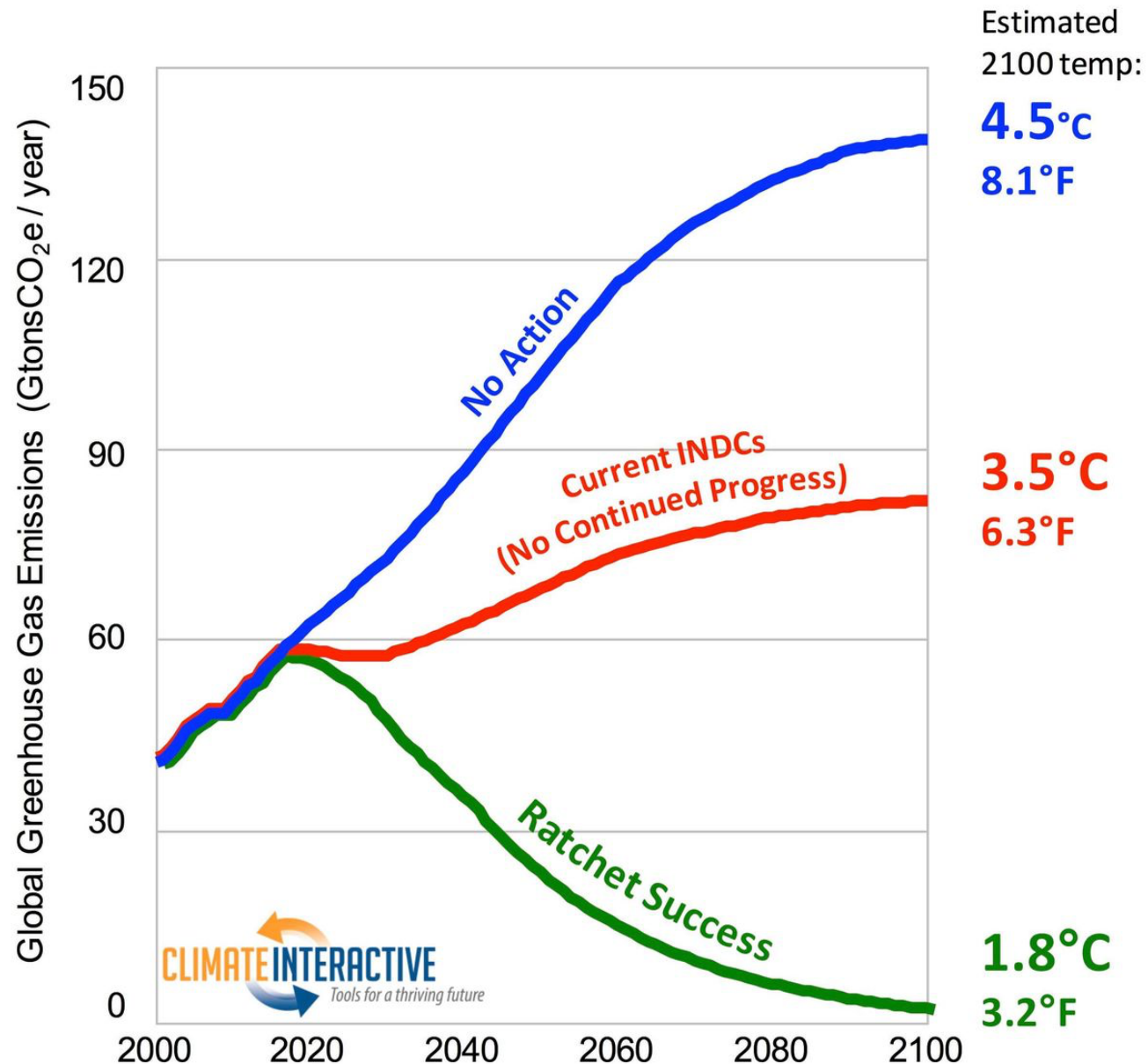
- 147 Heads of State attended COP21
 - Highest number *ever* gathered at any event!
- 183 Countries submitted intended commitments in advance of the meeting

Lima COP 20: call for climate action:

- Examples of “Intended Nationally Determined Contributions” (INDCs) to reduce greenhouse gas emissions:
 - Japan: 26% below 2013 levels by 2030
 - Australia: 26-28% below 2005 levels by 2030
 - USA: 32% below 2005 by 2030
 - EU: 40% below 1990 levels by 2030
 - Ethiopia: 64% below BAU scenario by 2030

Projections for COP21

- Need for immediate and substantial actions



**Could Policy to Combat Climate
Change be cost-free?**

**PUBLIC HEALTH co-benefits could
even make climate change policy a
net gain.**

The opportunity to avoid:

- 7.0 million deaths/yr. from air pollution
- 3.2 million deaths/yr. from physical inactivity
- Cardiovascular risk from high meat diet.

WHO and the Global Burden of Disease Report, 2013.



Asthma and Air Pollution

- Natural experiment during 1996 Summer Olympic games in Atlanta
- Peak morning **traffic** decreased 23% and peak **ozone** levels decreased 28%
- **Asthma**-related emergency room visits by children **decreased 42%**
- Children's emergency visits for non-asthma causes did not change during same period



A systems approach to evaluating the air quality co-benefits of US carbon policies

Tammy M. Thompson^{1*†}, Sebastian Rausch^{1†}, Rebecca K. Saari² and Noelle E. Selin^{2,3}

Because human activities emit greenhouse gases (GHGs) and conventional air pollutants from common sources, policy designed to reduce GHGs can have co-benefits for air quality that may offset some or all of the near-term costs of GHG mitigation. We present a systems approach to quantify air quality co-benefits of US policies to reduce GHG (carbon) emissions. We assess health-related benefits from reduced ozone and particulate matter (PM_{2.5}) by linking three advanced models, representing the full pathway from policy to pollutant damages. We also examine the sensitivity of co-benefits to key policy-relevant sources of uncertainty and variability. We find that monetized human health benefits associated with air quality improvements can offset 26–1,050% of the cost of US carbon policies. More flexible policies that minimize costs, such as

“...health benefits...can offset 26-1050% of the cost of US carbon policies”

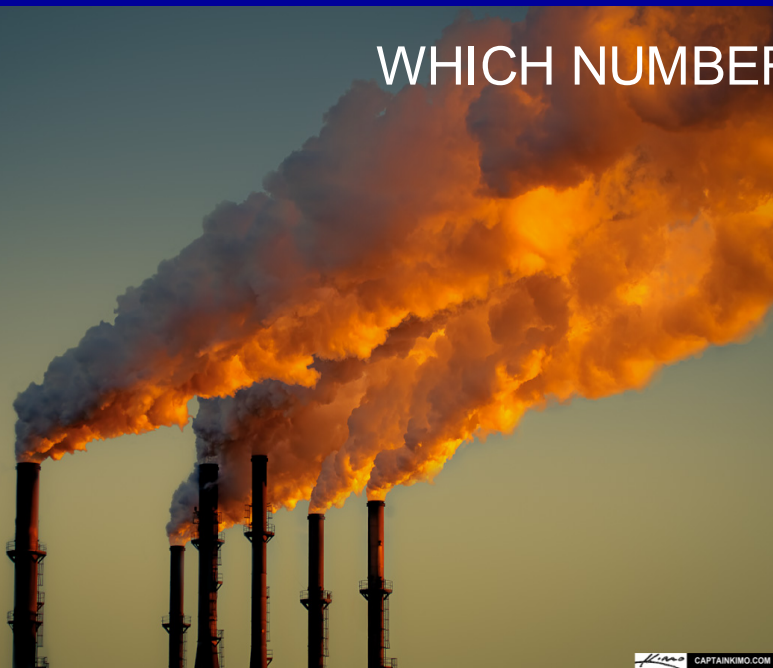
- ***Cost of cleaner energy:***

$< \$30/ tCO_2$

- ***Benefits of cleaner energy:***

$\$200^*/ tCO_2$

WHICH NUMBER IS BIGGER???



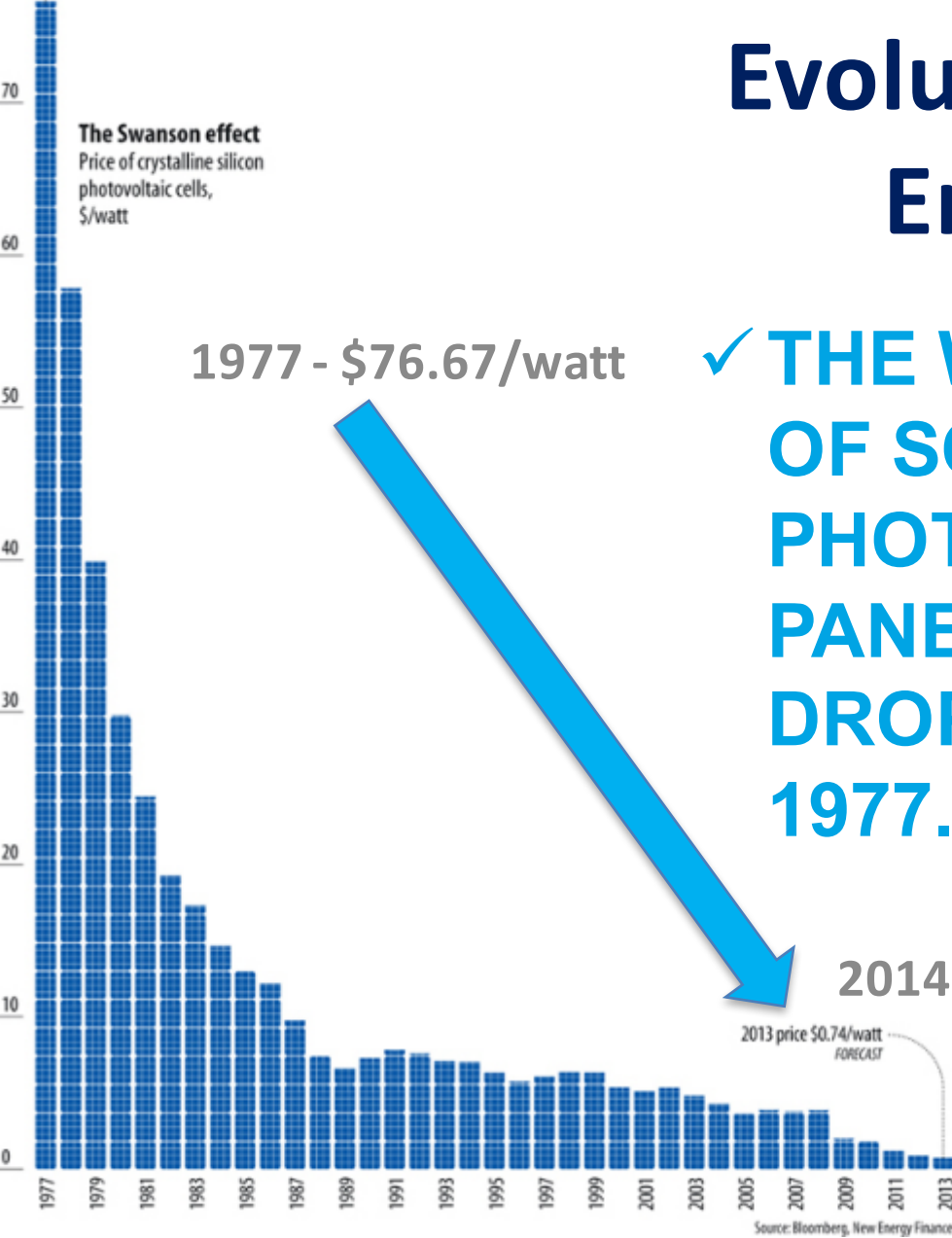
(* Range: \$50 to \$380)

For E. Asia, co-benefits are **10 to 70 times** greater

West et al. 2013

Evolution of Solar Energy . . .

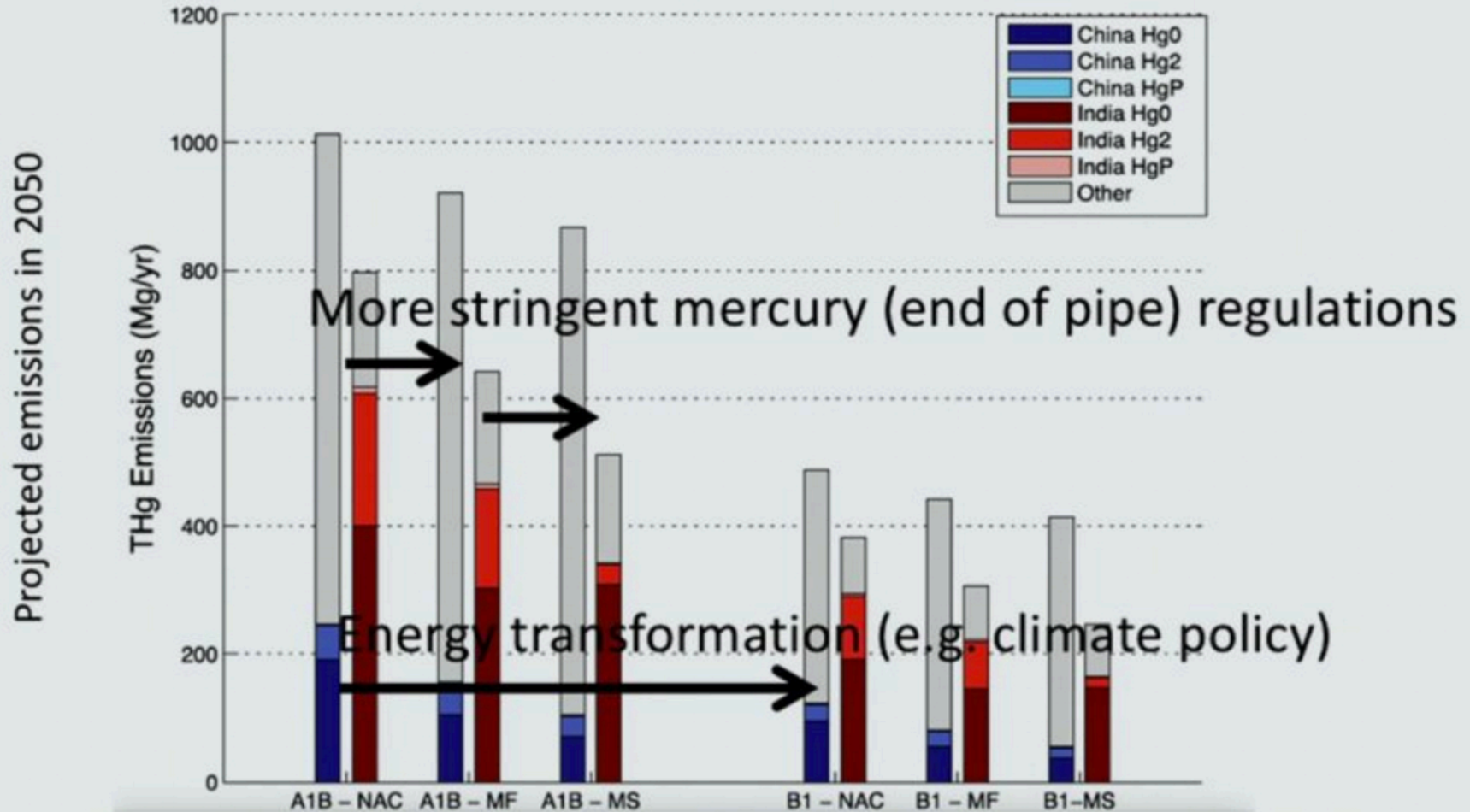
✓ **THE WHOLESALE PRICE OF SOLAR PHOTOVOLTAIC (PV) PANELS (\$/WATT) HAS DROPPED BY 99% SINCE 1977.**



Source: Bloomberg New Energy Finance

Controlling CO₂ can also benefit mercury....

...and more stringent controls have primarily domestic benefit in China and India



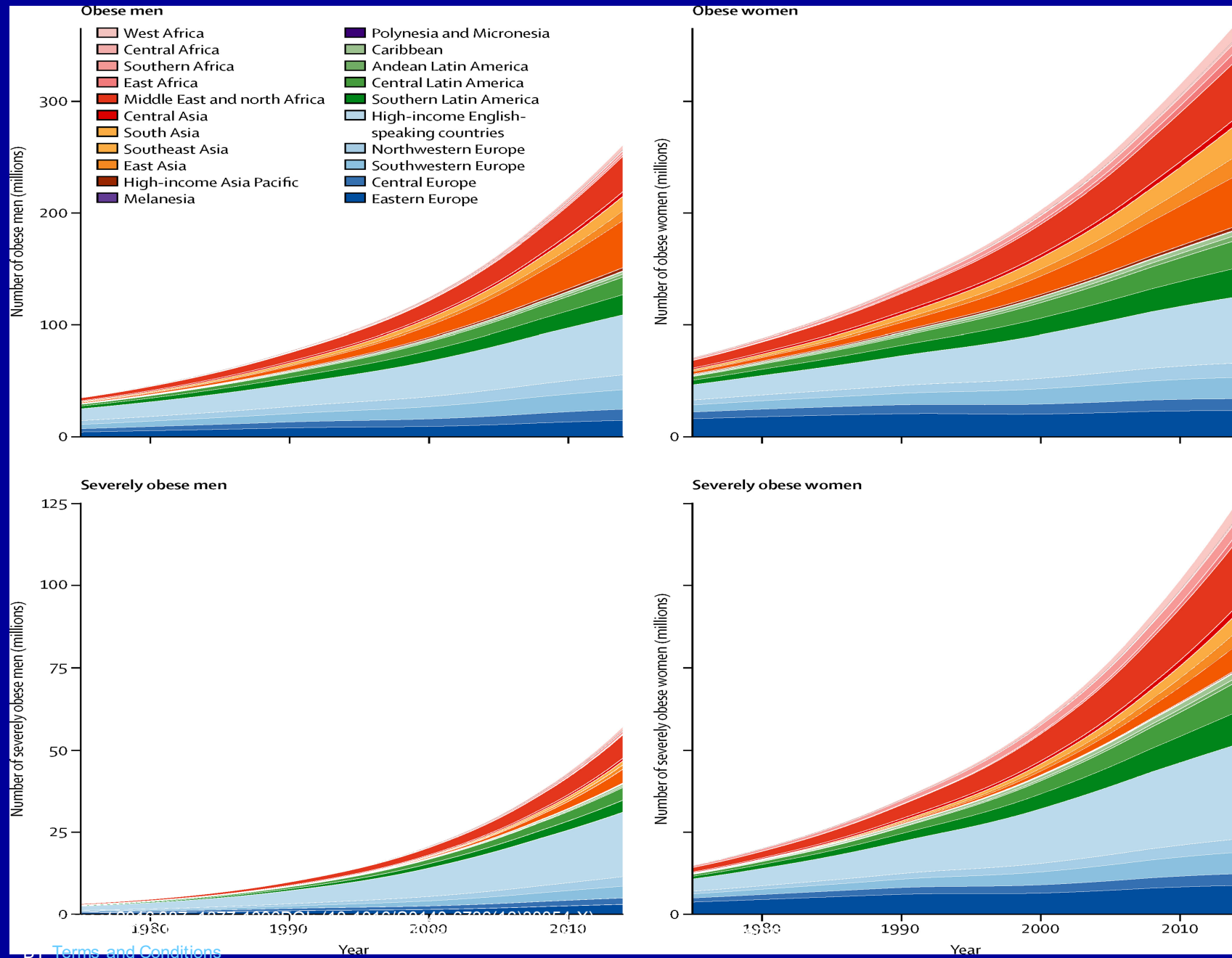
For more information: A. Giang, L. C. Stokes, D. G. Streets, E. S. Corbitt, and N. E. Selin. 2015. "Impacts of the Minamata Convention on mercury emissions and global deposition from coal-fired power generation in Asia." *Environmental Science and Technology* 49, 5326-5335.


Global Obesity Trends

“Trends in adult body-mass index in 200 countries from 1975 to 2014: ...studies with 19.2 million participants...”

Ezati et al. *The Lancet*, April 2016

Trends in the number of obese and severely obese people by region



An aerial photograph of a suburban neighborhood. A large, circular road with a median runs through the center of the image. The road is paved and has a light-colored curb. On either side of the road are numerous houses, mostly two-story, light-colored buildings with dark roofs. The houses are set back from the road by lawns and driveways. The overall layout suggests a planned, car-oriented community.

Neighborhoods designed for automobiles rather than for people are not health promoting and are contrary to a “LIVABLE CITY”

Enormous health opportunity from “Active Transport”

- **60% of Americans do not meet
recommended levels of aerobic exercise**

(DHHS, 2008)

40% of trips by car are < 3 km

(Dept of Transportation)

From transportation...to human health

Research question #2:

Assume half of
short trips could be
accomplished by bicycle,
during the summer only.

Wh
im
po

Health “co-benefits” from reduced fossil fuel combustion

Study of the Day: Biking to Work Could Save 1,100 Midwesterners

NOV 2 2011, 8:00 AM ET

New research from U. Wisconsin projects the benefits of air quality and physical fitness

Swapping Tail Pipes For Pedals: Small Changes Could Pay Huge Dividends For Public Health And Economy



Grabow et al. 2012 (J. Patz research lab)

U.S. cities with the highest rates of walking and cycling to work...

- have **obesity rates 20 percent lower**, and **diabetes rates 23 percent lower** — compared with U.S. cities with the lowest rates of walking and cycling.

Health effects of increased active travel by disease in London (d(diabetes, depression and bowel cancer not shown))

	Change in disease burden	Change in premature deaths
Ischaemic heart disease	10-19%	1443-2207
Cerebrovascular disease	10-18%	866-1271
Dementia	7-8%	195-250
Breast cancer	12-13%	203-211
Road traffic crashes	19-39%	47-86

Co-benefits: Food and Agriculture



People's Climate March, Sept. 21, 2014, NYC
Photo: J Patz

Diet and GHG Emissions

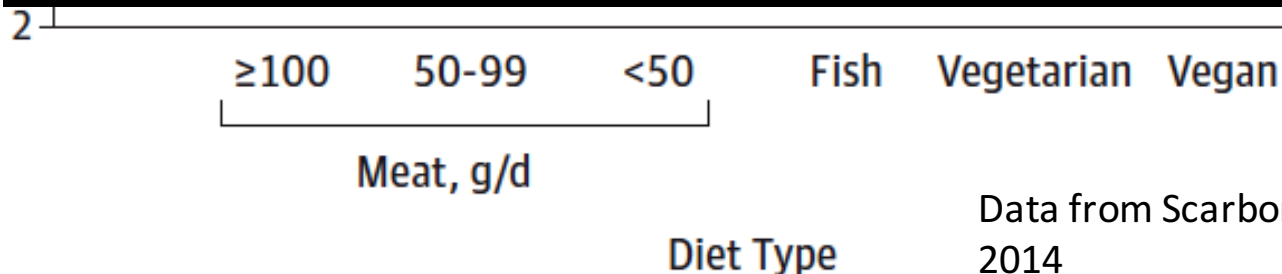
Mean Carbon Dioxide Equivalents per d, kg

If meat consumption was halved in the UK, GHGs could be reduced by 25–40% and intake of saturated fat could fall by 40%

Westhoek, 2014

Heart disease burden could fall by 15%

Friel, 2009



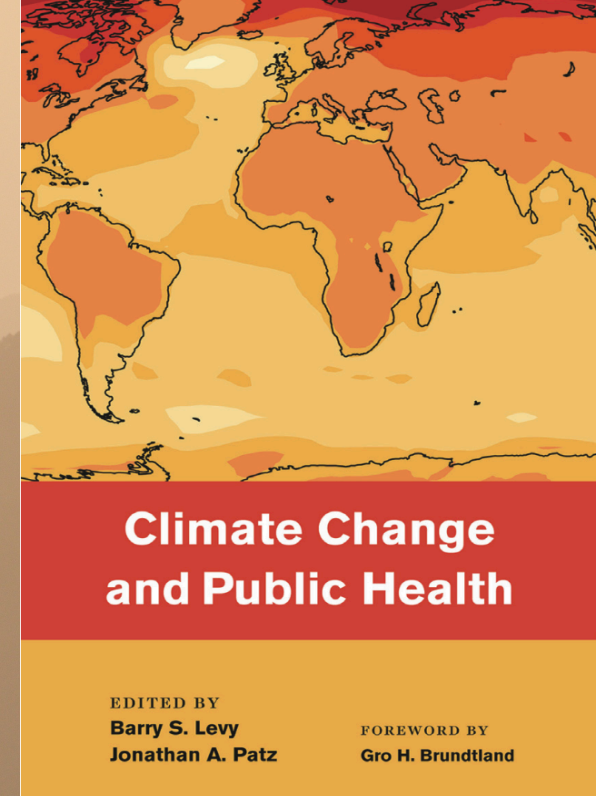
Data from Scarborough et al.
2014

A group of cyclists, some wearing bright green jackets and others in darker clothing, are riding along a city street. They are positioned in a line, moving from left to right. The street is paved with asphalt and has white lane markings. In the background, there are multi-story brick buildings with many windows. A silver car is parked on the right side of the street, and a blue van is visible further back. A blue sign on a black pole on the right side of the street reads "CYCLE LANE" and "LOOK BOTH WAYS". The overall scene suggests a healthy, active urban environment.

A Low-carbon economy can make
us healthier ...and save money

Especially from changes in:
Energy production
Transportation and urban planning
Food systems

Thank you
very much!



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