Climate Change and Health: Great Risks AND Opportunities

Climate Change & Health Plenary

APHA Annual Conference

Washington, Nov.6, 2007

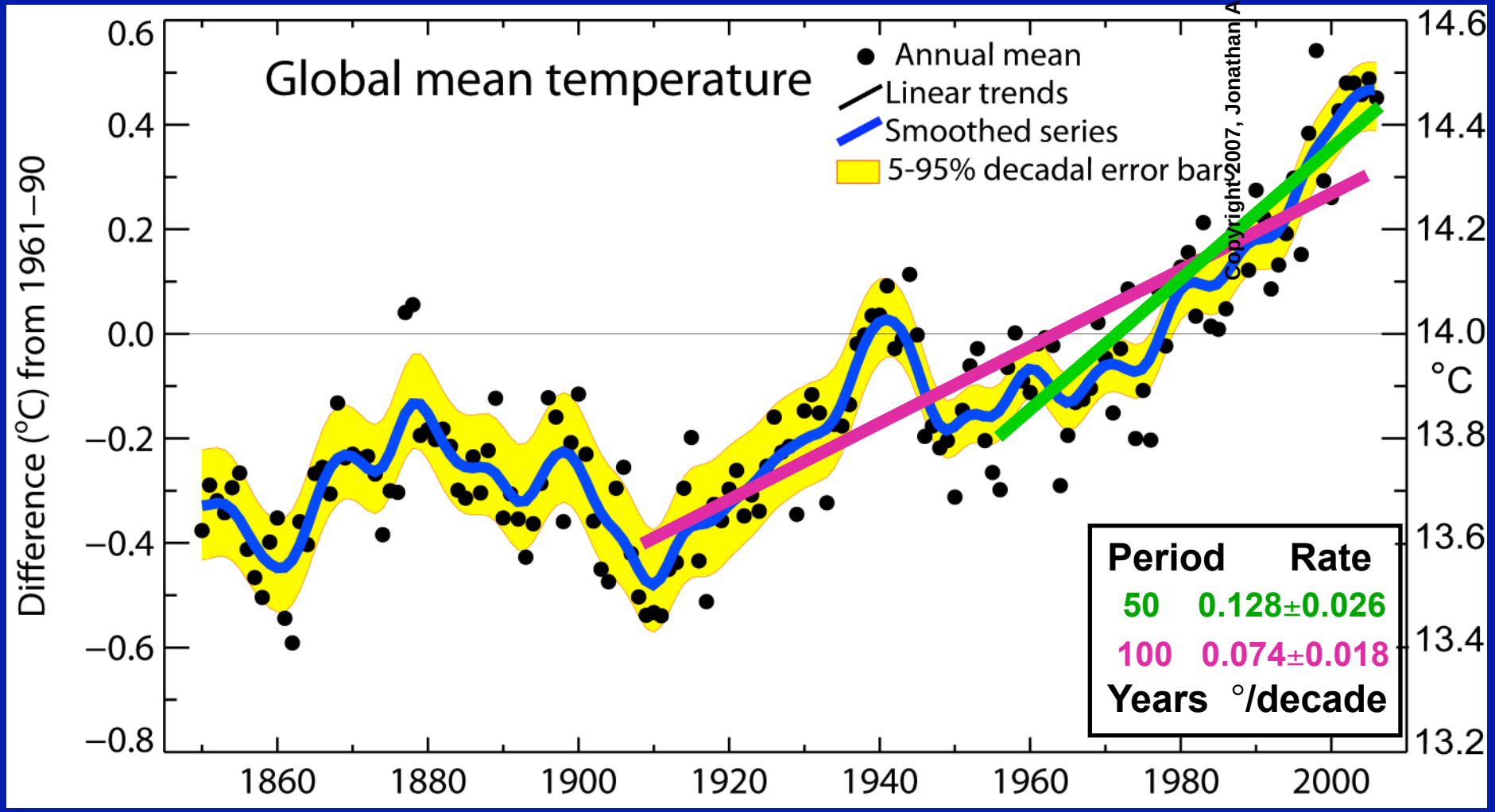
Jonathan Patz, MD, MPH

SAGE , Nelson Institute for Environmental Studies

Department of Population Health Sciences

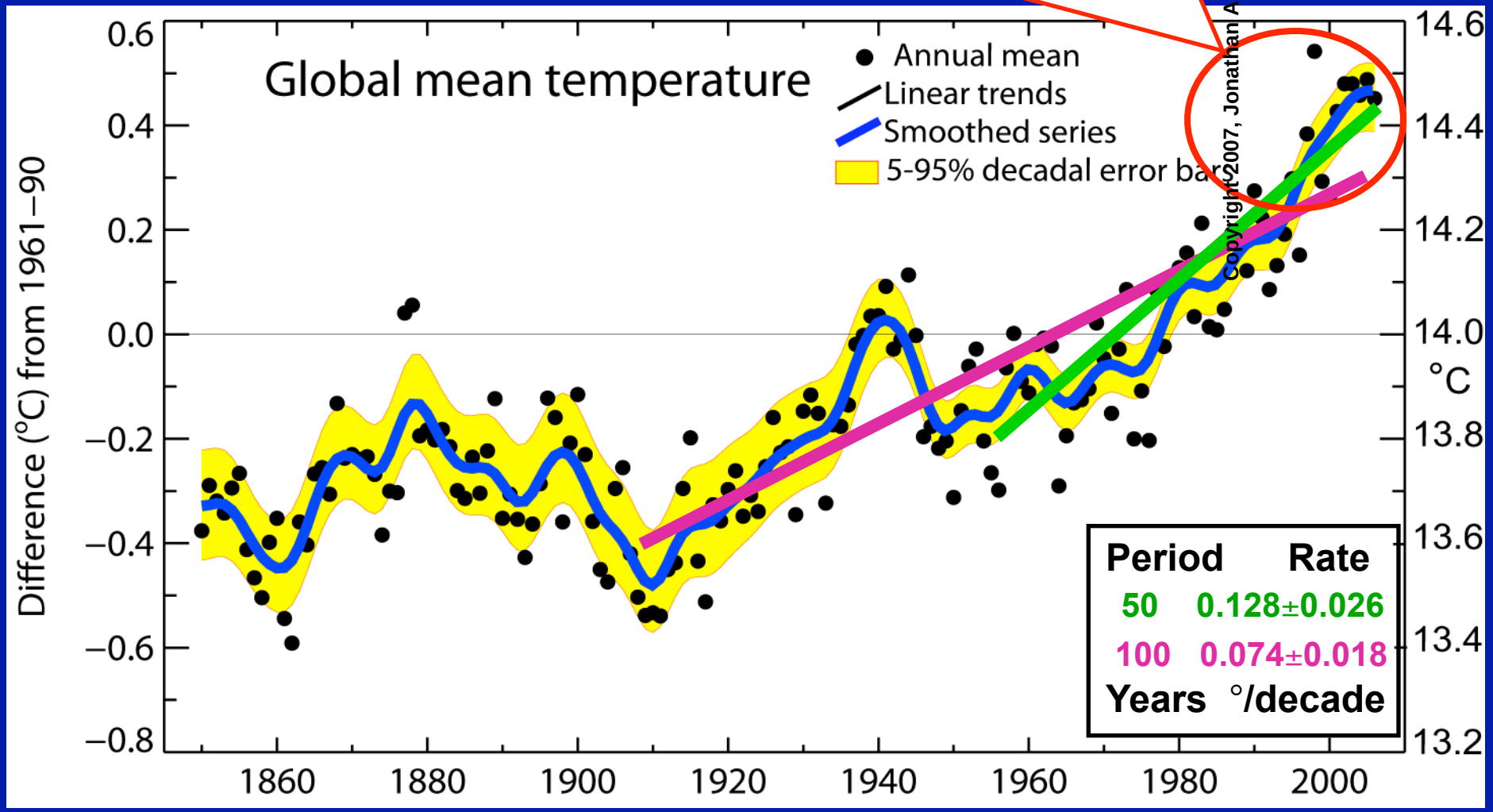
University of Wisconsin – Madison

Global mean temperatures are rising faster with time



Global mean temperat[illegible]

Warmest 12 years:
1998, 2005, 2003, 2002, 2004, 2006,
2001, 1997, 1995, 1999, 1990, 2000



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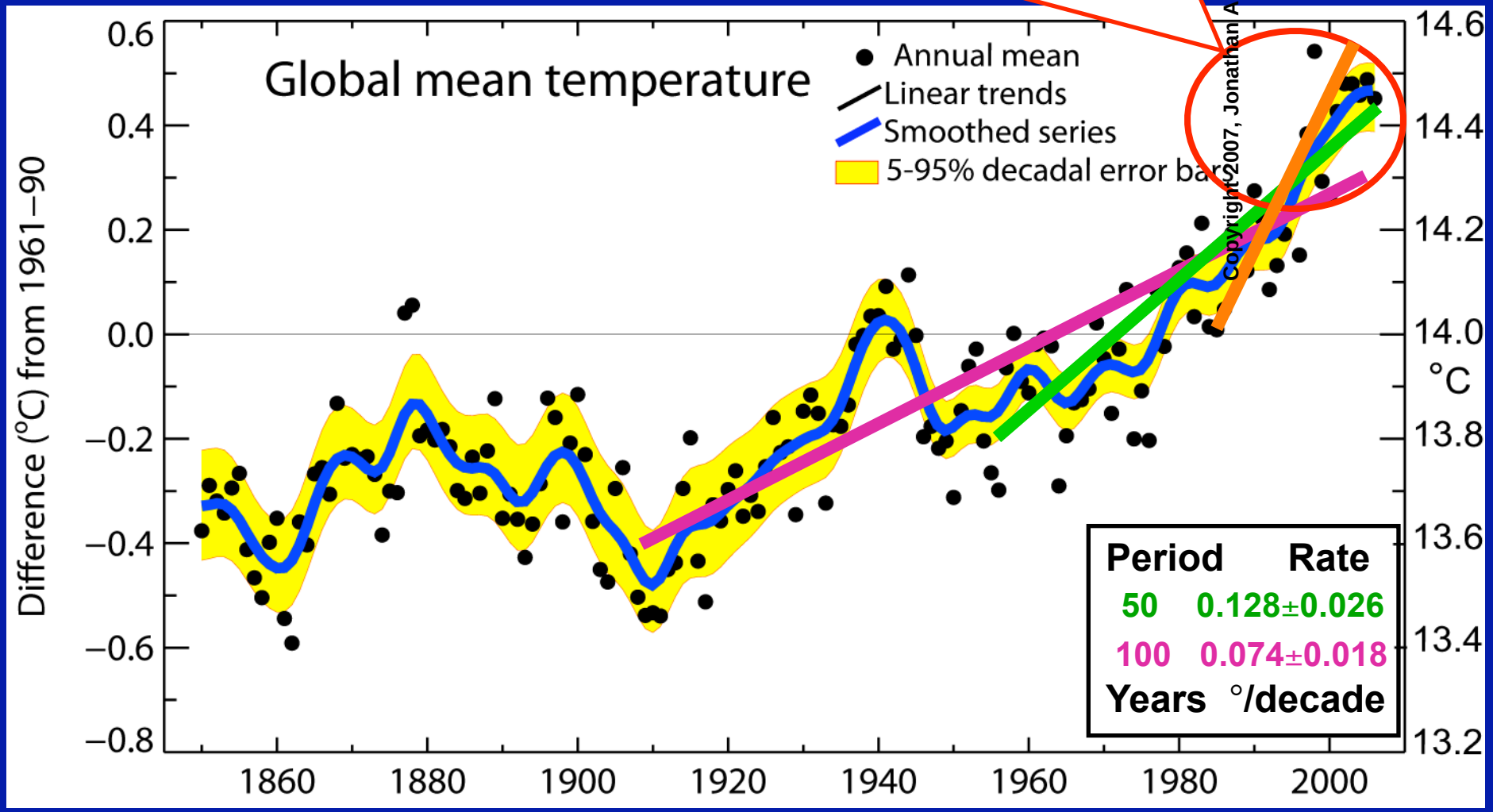


But the polar bear might not be the only threatened species

But the polar bear might not be the only threatened species

"How it threatens your health"

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

Patz, 1998

Urban Heat Island Effect	Heat Stress Cardiorespiratory failure
Air Pollution & Aeroallergens	Respiratory diseases, e.g., COPD & Asthma
Vector-borne Diseases	Malaria Dengue Encephalitis Hantavirus Rift Valley Fever
Water-borne Diseases	Cholera Cyclospora Cryptosporidiosis Campylobacter Leptospirosis
Water resources & food supply	Malnutrition Diarrhea Toxic Red Tides
Mental Health & Environmental	Forced Migration Overcrowding Infectious diseases Human Conflicts

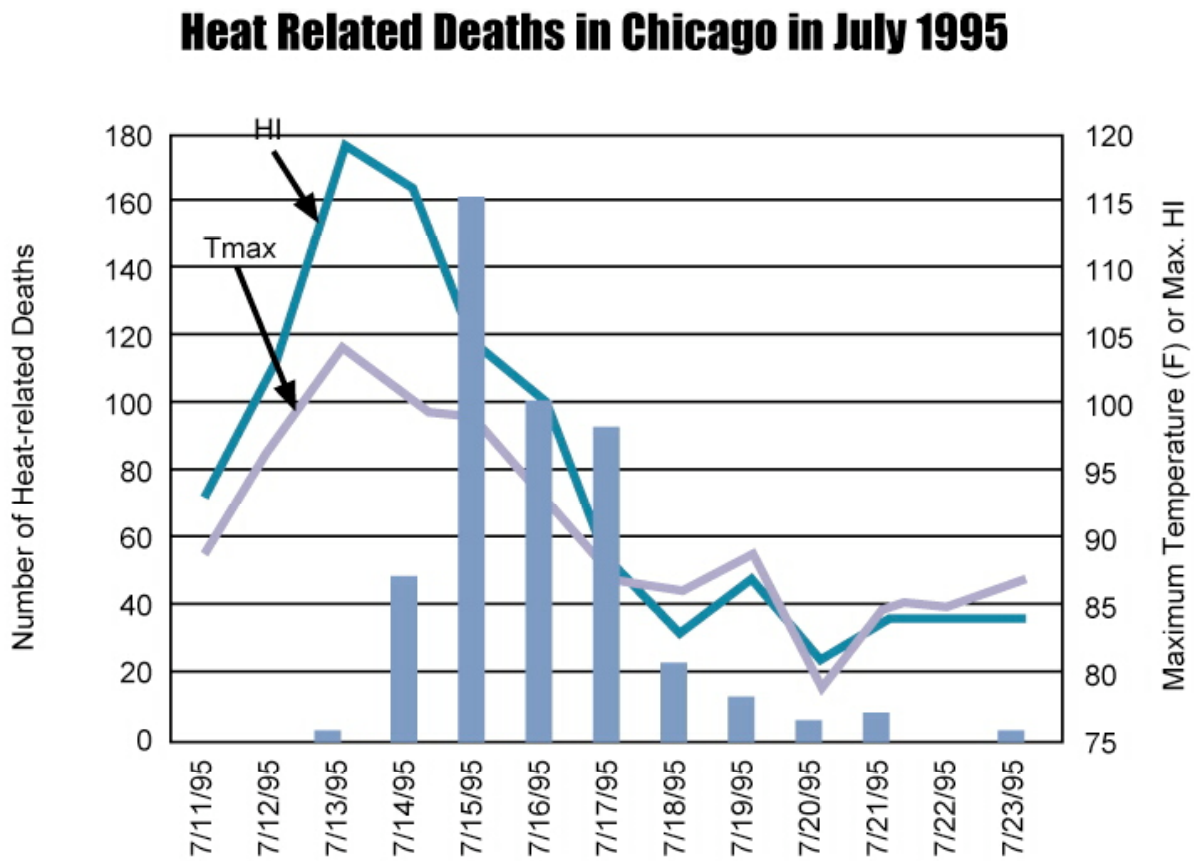
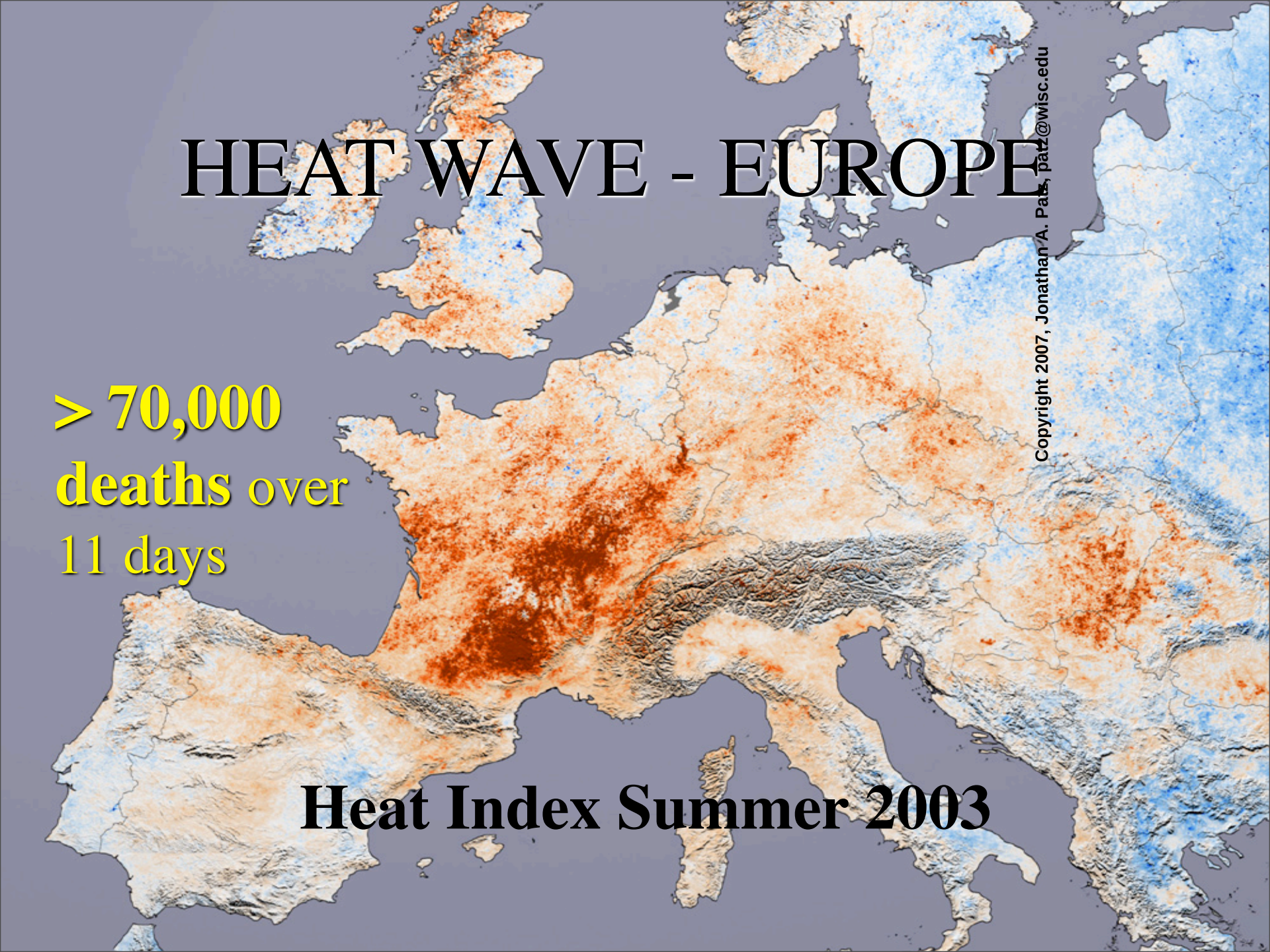
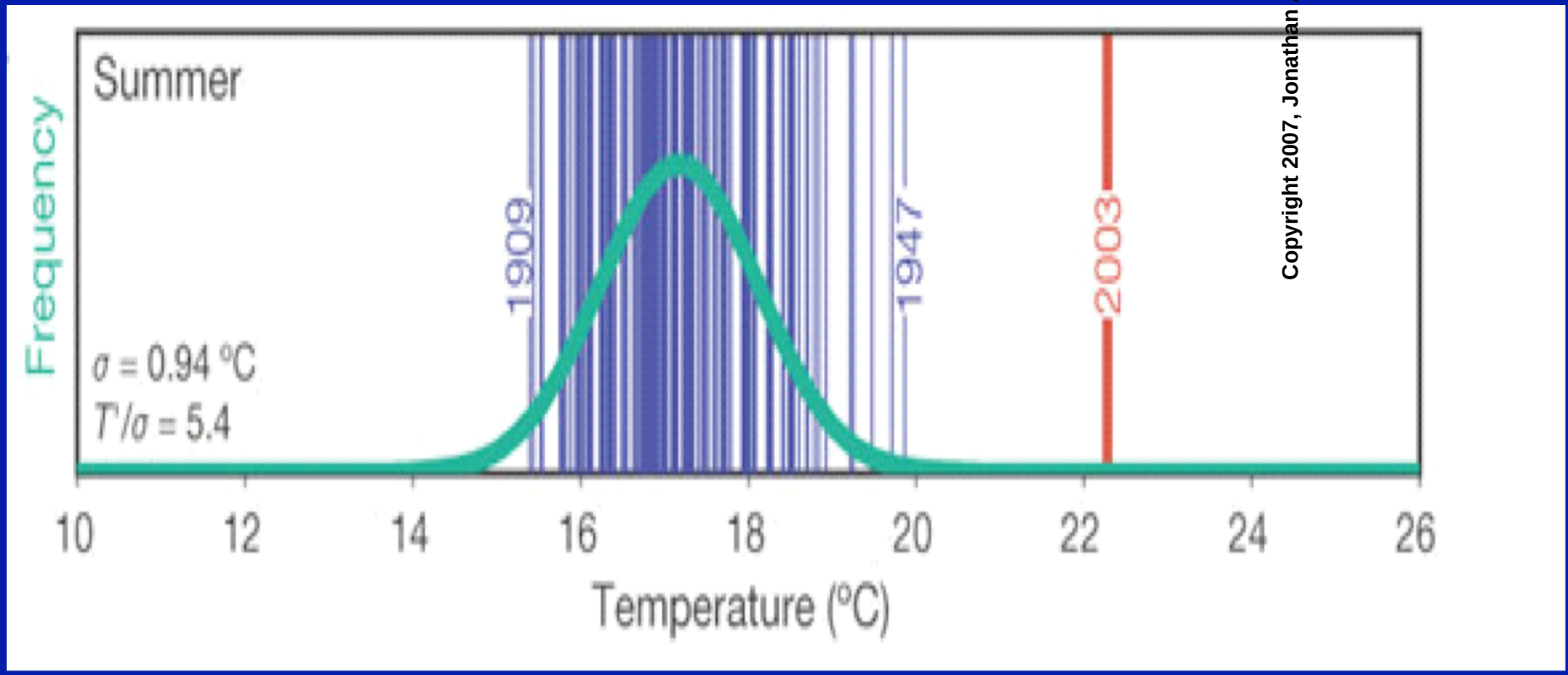


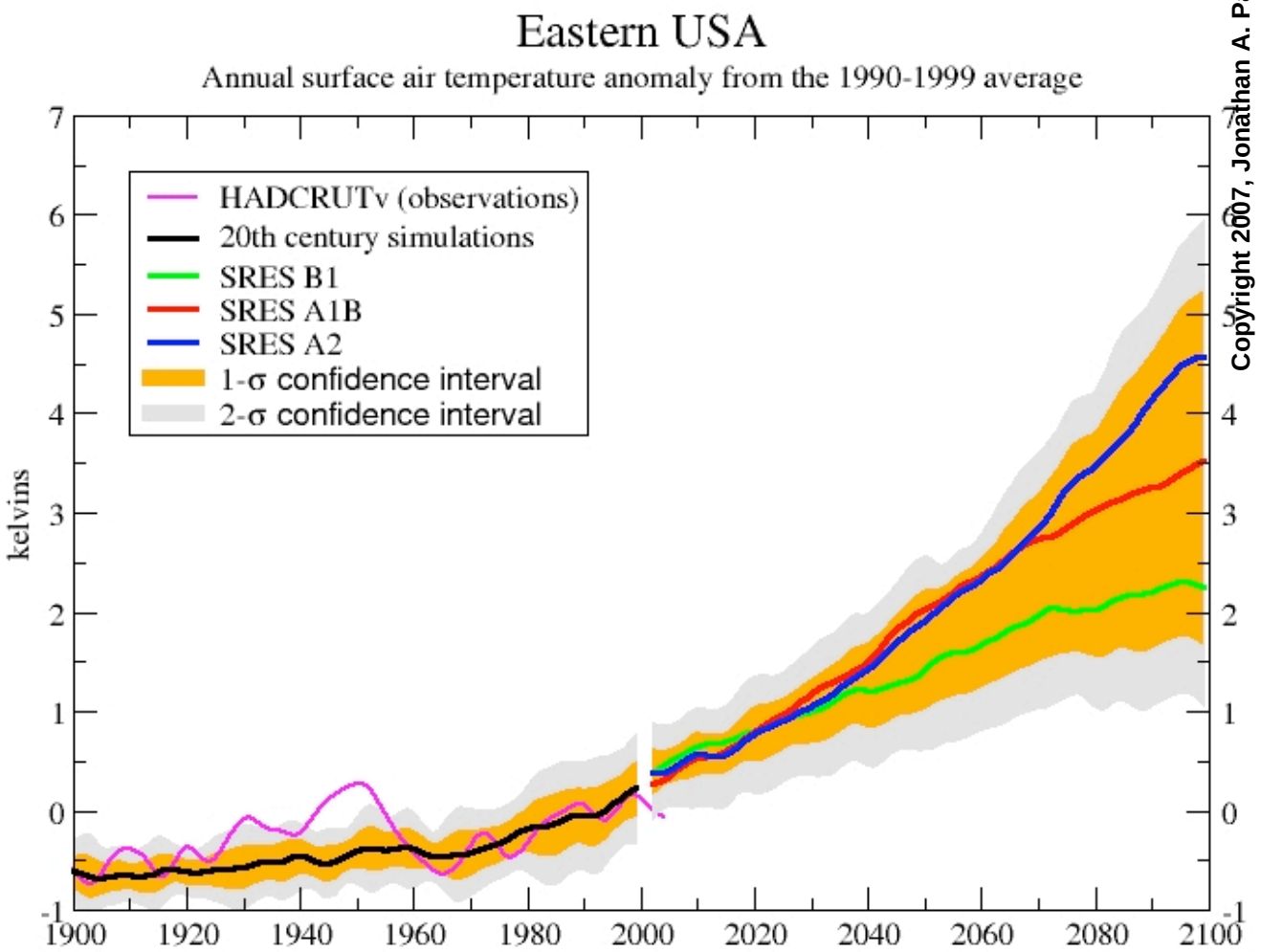
Figure 3: This graph tracks the maximum temperature (Tmax), heat index (HI), and heat-related deaths in Chicago each day from July 11 to 23, 1995. The gray line shows maximum daily temperature, the blue line shows the heat index, and the bars indicate the number of deaths each day. Source: NOAA/NCDC.


HEAT WAVE - EUROPE
> 70,000 deaths over 11 days
Heat Index Summer 2003
Copyright 2007, Jonathan A. Patz, patz@wisc.edu

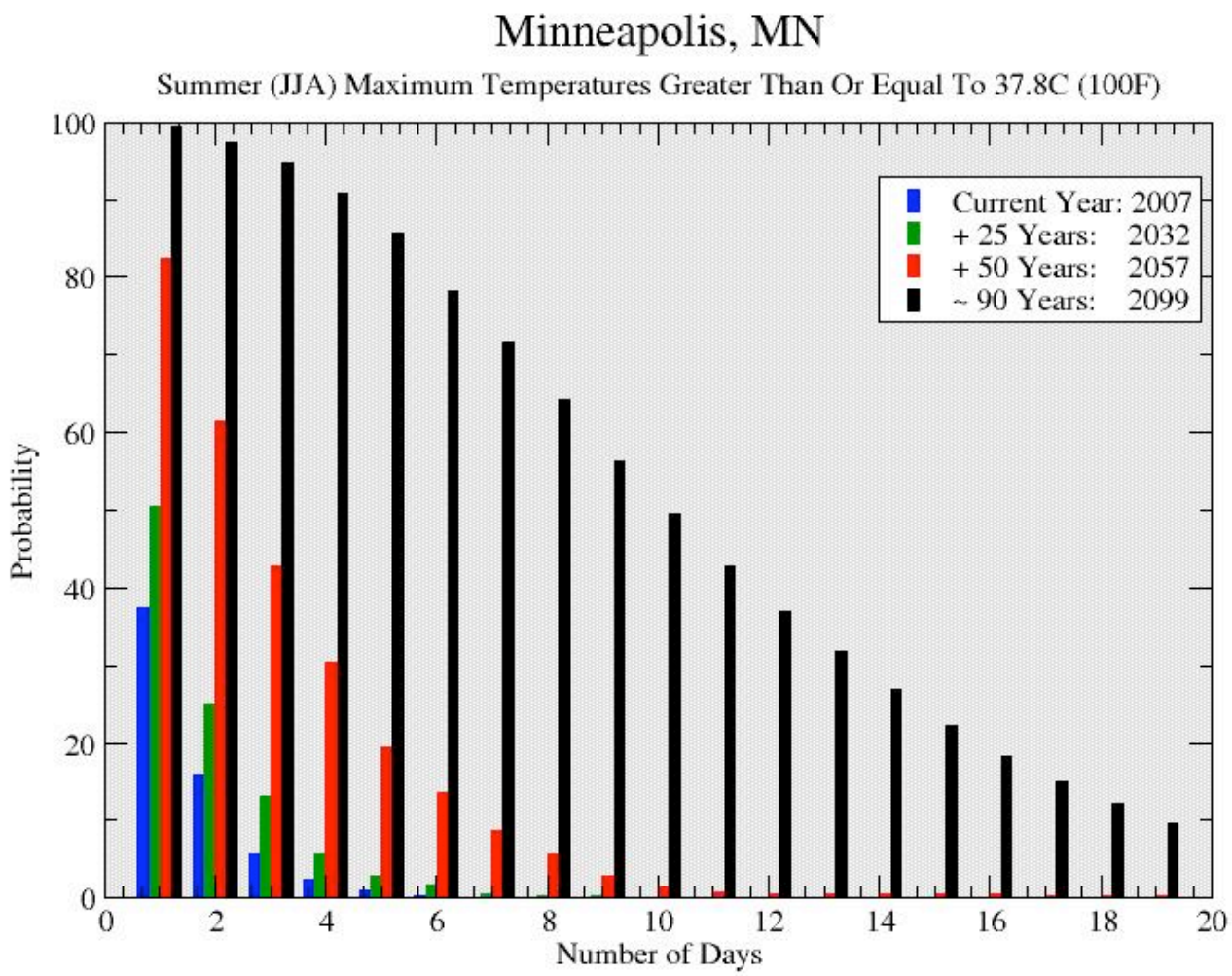
Comparing the 2003 Heatwave to past summer climate



European heat wave of 2003, from Schär et al., 2004



Probabilities of future extremes can be estimated given projections of mean temperature



Peterson et al.,

17 November 2005 | www.nature.com/nature | £10

THE INTERNATIONAL WEEKLY JOURNAL OF SCIENCE

nature

CLIMATE CHANGE

Regional health impacts from North America to Africa

PLASMON OPTICS
Towards the perfect lens

EMERGING DISEASES
The Typhoid Mary factor

STAR FORMATION
Boost for a collapsing theory

- **"The severity and duration of summertime regional air pollution episodes are projected to increase in the Northeast and Midwest US by 2045-2052 due to climate-change-induced decreases in the frequency of surface cyclones."** (IPCC, 2007)

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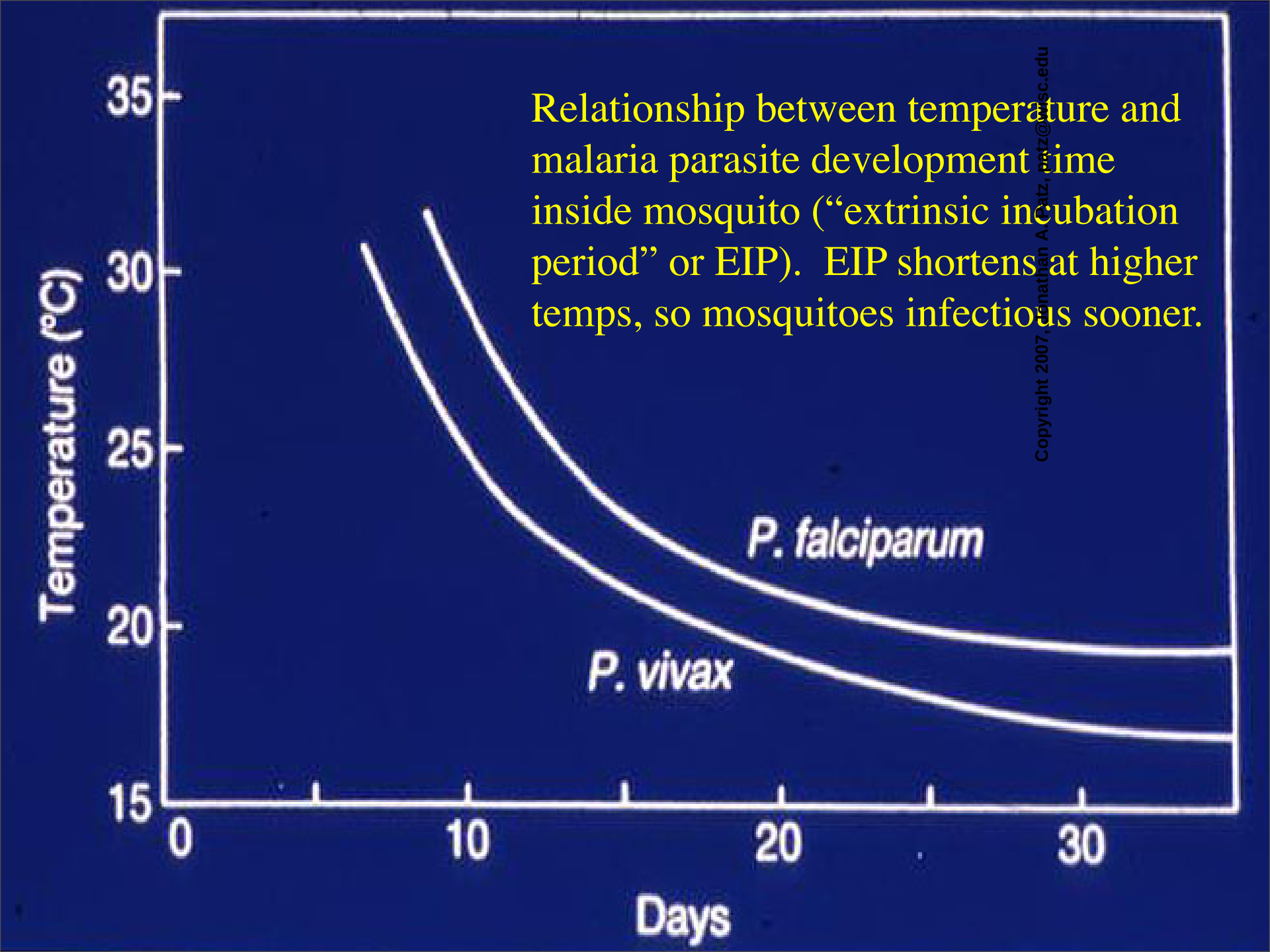
- **By 2050, warming alone may increase by 68% the number of Red Ozone Alert days across the Eastern US.** (IPCC, 2007 -Bell et al, 2006)


HEALTH PROFESSIONALS AND SCIENTISTS WARN OF SPREADING INFECTIOUS DISEASES.
Global Warming's greatest threat may also be the smallest.



Relationship between malaria and altitude, Zimbabwe.

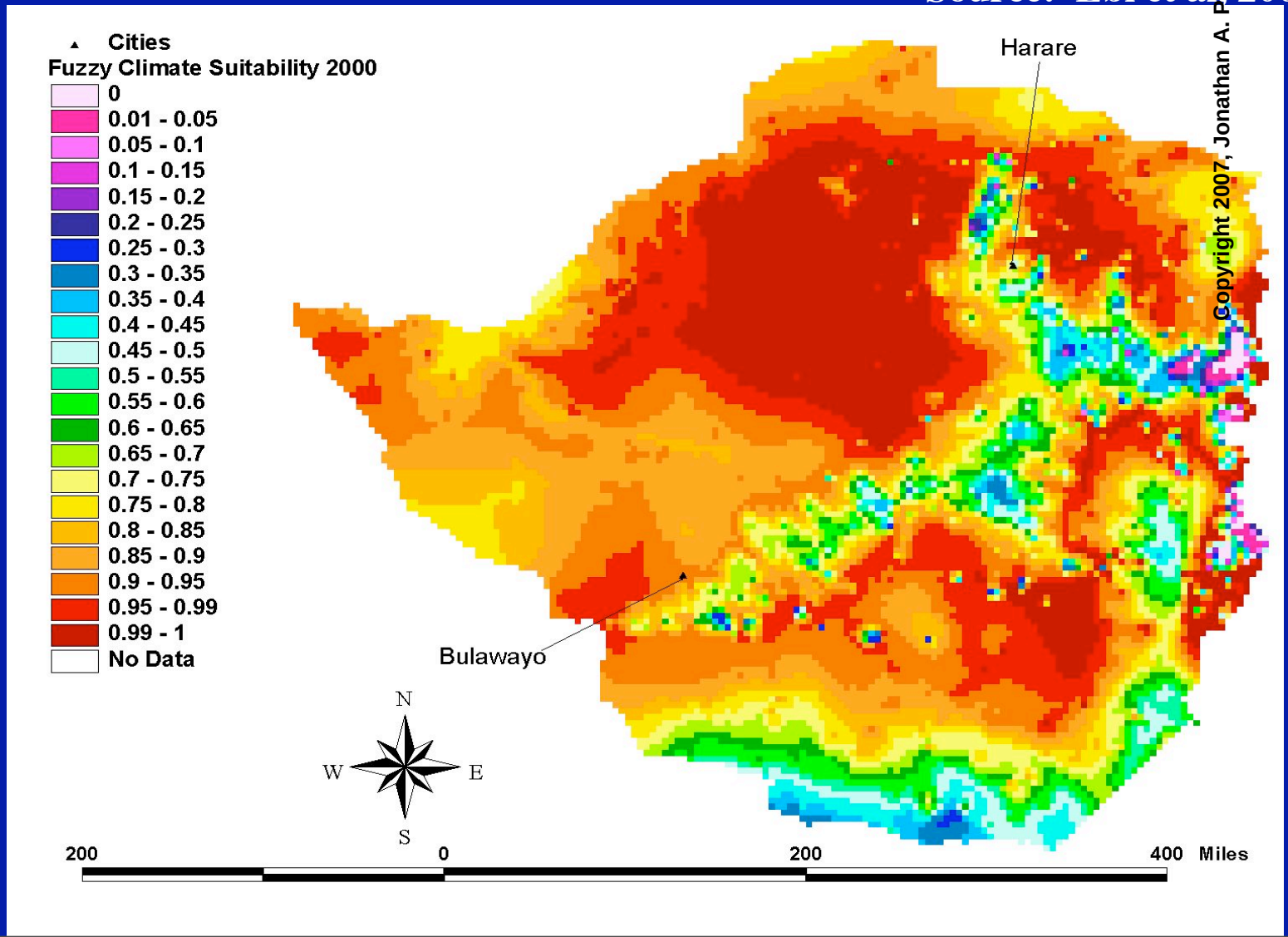
Altitude a good surrogate for temperature: the average temperature decrease with height = **6° C per 1000 meters**

Average annual prevalence and incidence/100,000 population of malaria by altitude zone for the years 1969-1981 and 1972-1981, respectively (Taylor & Mutambu, *Trans. Royal Soc.Trop. Med. & Hyg.*, 1986; 80: 12-19).

Source: Taylor and Mutambu, 1986

Baseline 2000 2025 2050 2075 2100

Source: Ebi et al, 2005



Baseline 2000 2025 **2050** 2075 2100

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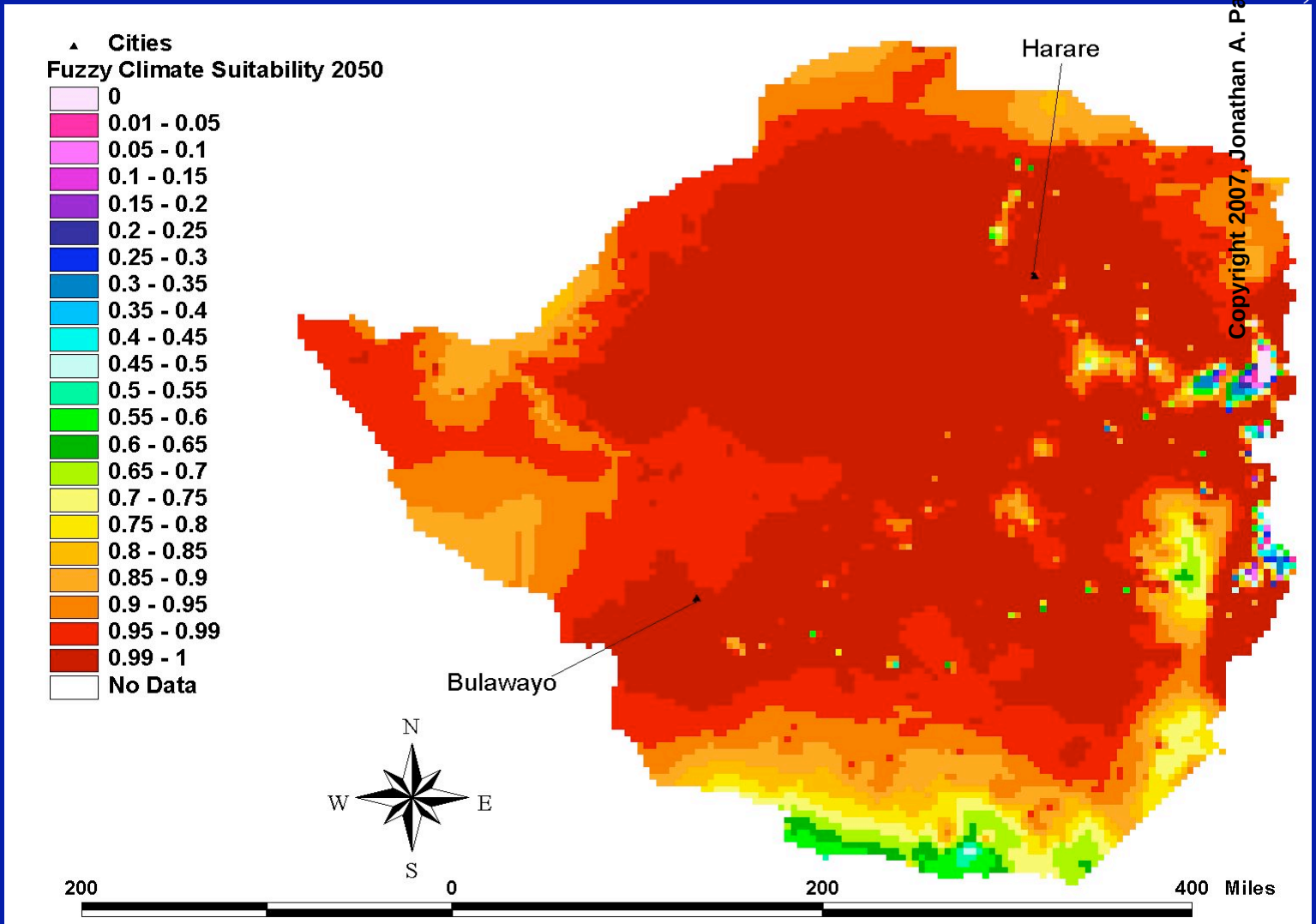
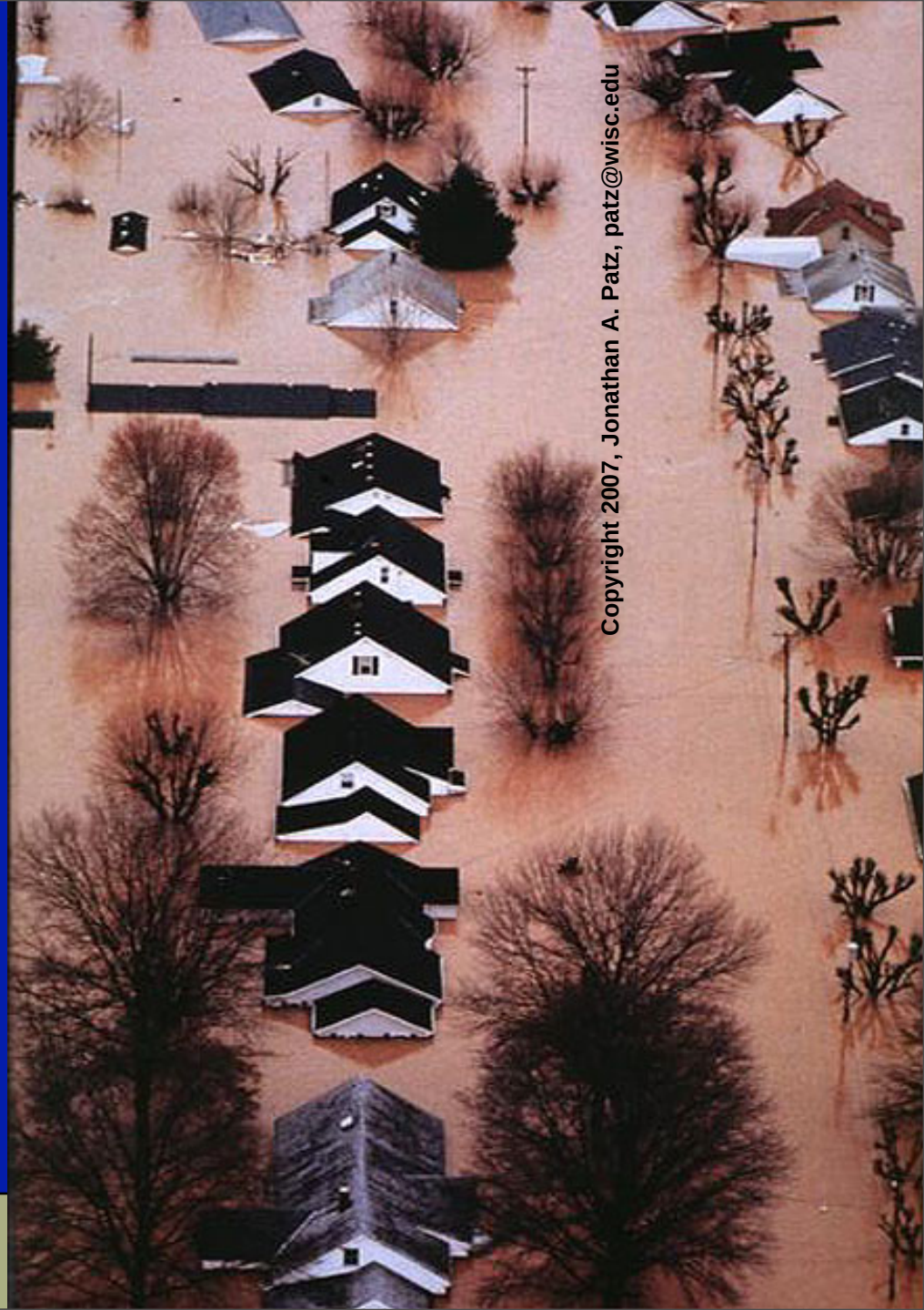
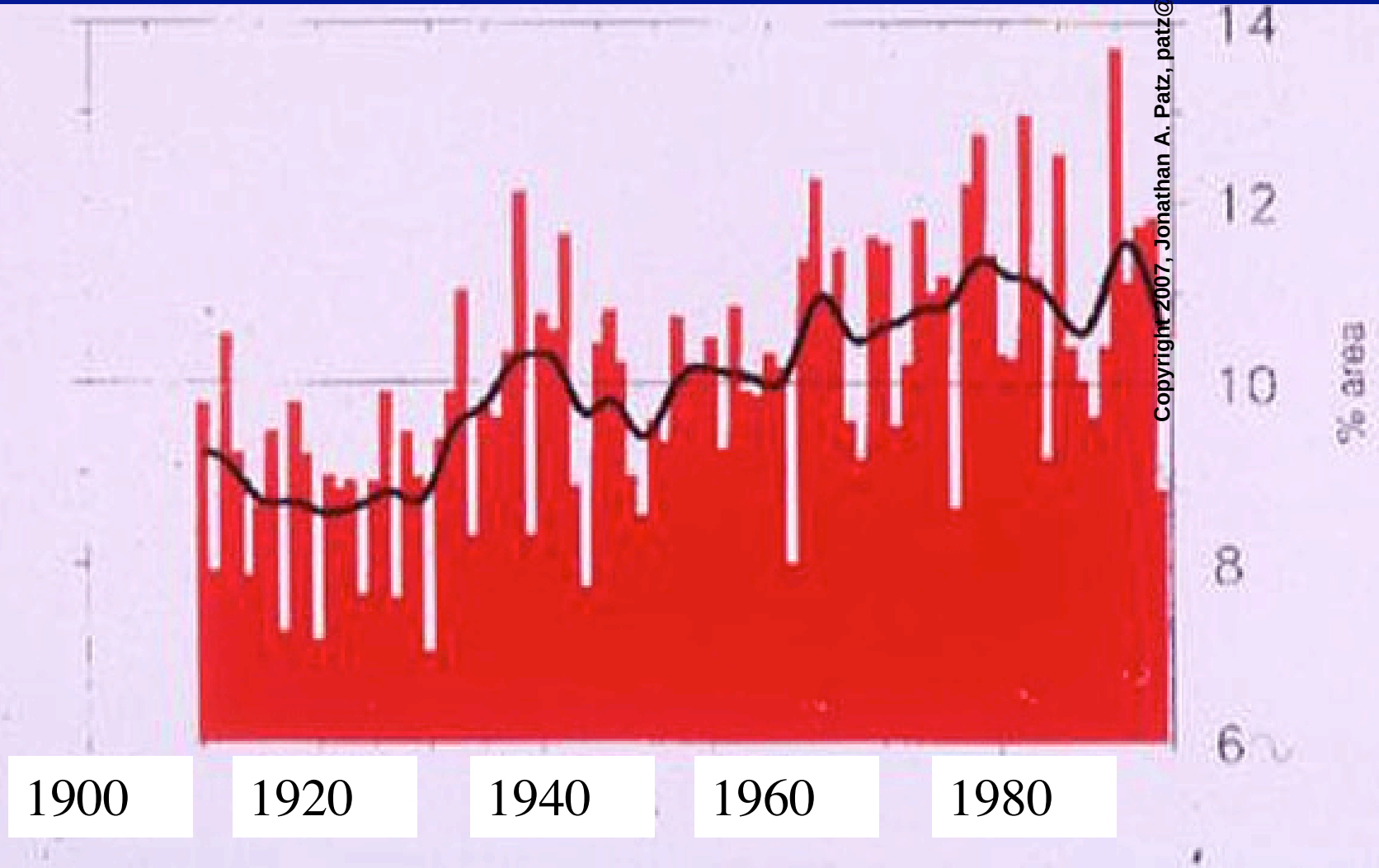


Climate change:

It's not just about warming.



Proportion of the USA affected by much above normal annual precipitation from extreme events (>2 inches/day)



Source: Karl et al. 1996

annual precipitation derived from extreme daily precipitation events (more than 2 inches)

Extreme Precipitation and Waterborne Disease Outbreaks in the United States, 1948 -1994

Project Sponsor:

US EPA, Office of Research & Development

PI: J. Patz

Results

- **67% of waterborne disease outbreaks were preceded by precipitation above the 80th percentile** (across a 50 yr. climate record), $p < 0.001$

- **51% of outbreaks were preceded by precipitation above the 90th percentile,** $p < 0.002$

- Surface water-related outbreaks had strongest correlation with extreme precipitation in the month of outbreak; groundwater-related outbreaks lagged 2 months following extreme precipitation.

Curriero, Patz, et al, 2001.

USA: Combined sewer overflows (CSOs)

1.2 trillion gal of sewage & stormwater a year discharged during combined sewer overflows – would keep Niagara Falls roaring for 18 days

Center for Water & Health, JHU Bloomberg School of Public Health

Heavy precipitation is projected to increase

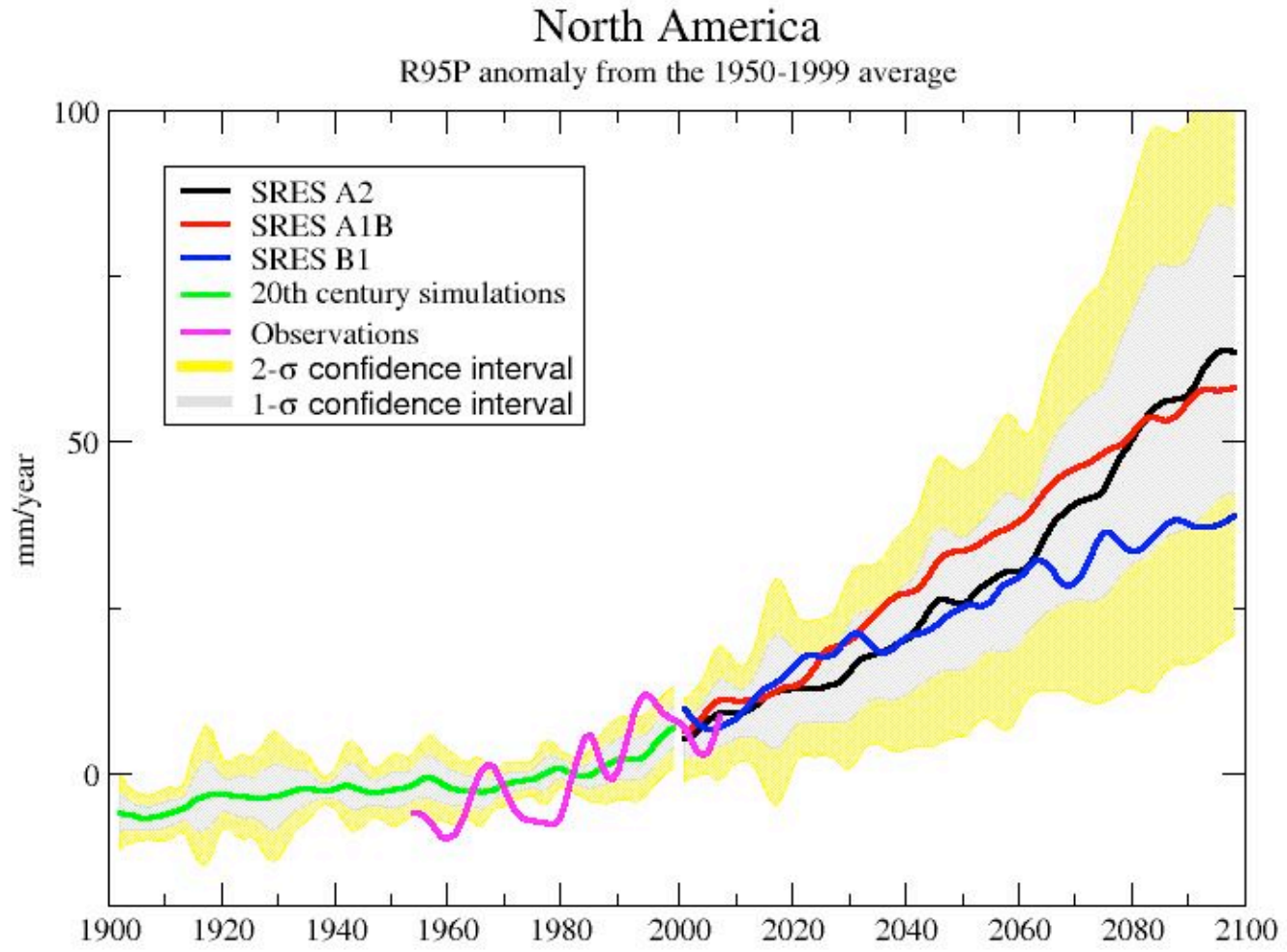
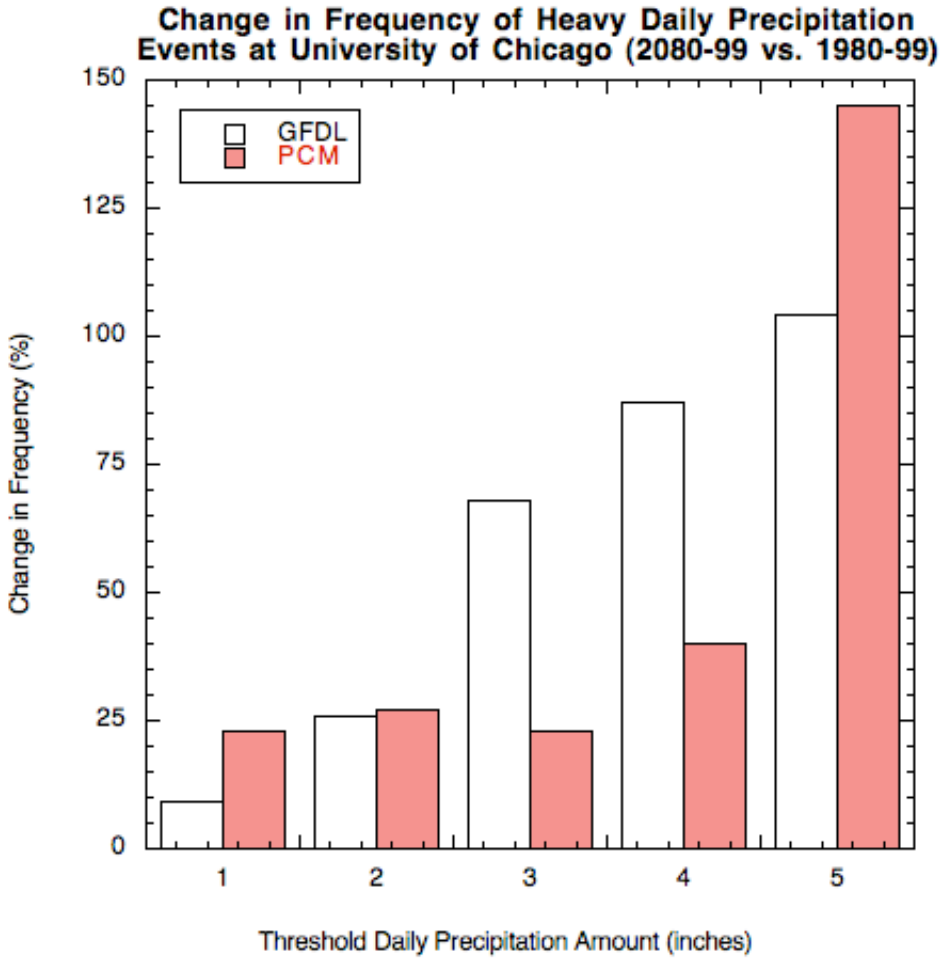


Figure courtesy of M. Wehner

Projected change in the frequency of heavy precipitation in Chicago by the late 21st century, based on downscaled climate model output from two GCMs used in the Chicago Climate Impact Assessment.



Courtesy: S. Vavrus

Universiy of Wisconsin-Madison

Unpublished data

EPA STAR Grant project

J Patz, PI

2007 Nobel Laureate Al Gore

2007 Nobel Laureate Al Gore

New Orleans

after Hurricane Katrina

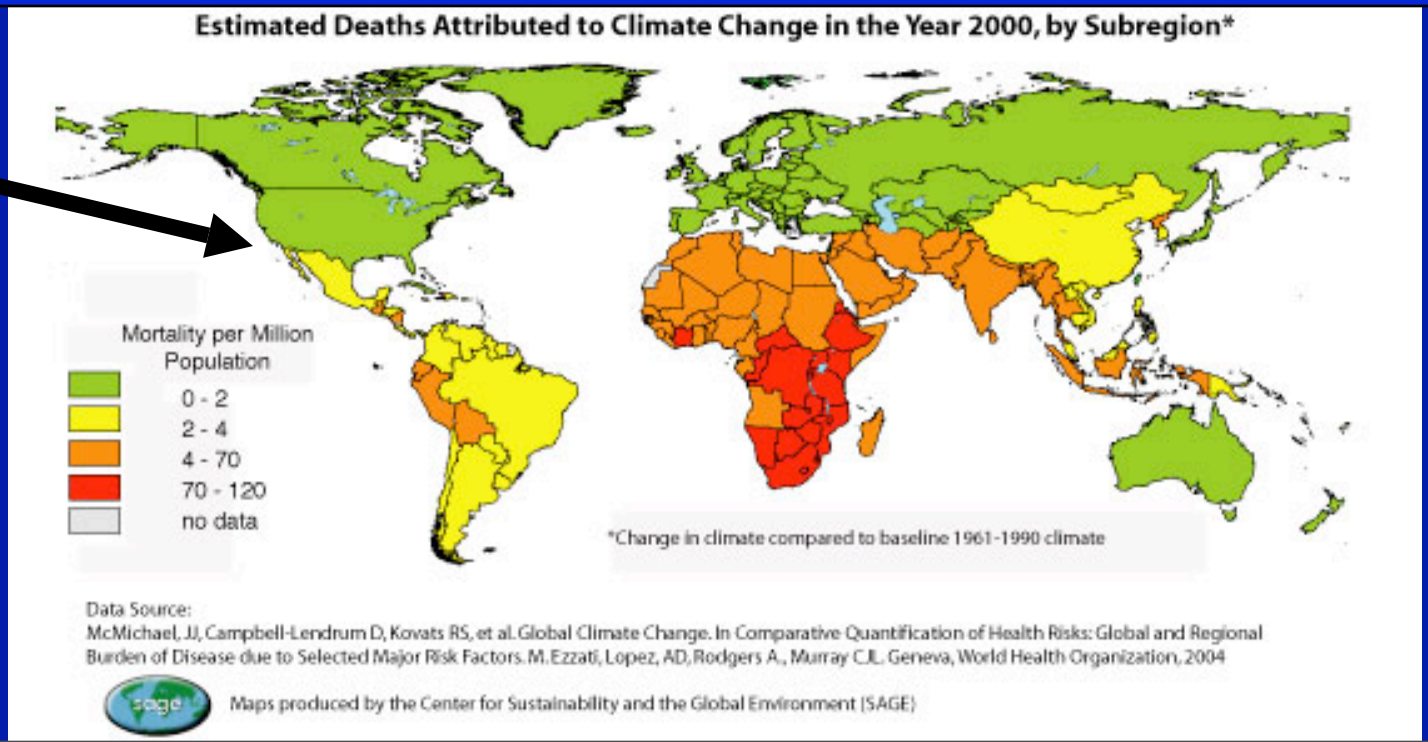
Climate change is already contributing to morbidity and mortality

Warming during 1970-2000 is estimated to have caused at least 160,000 deaths and 5 million DALYs annually (from just 4 outcomes: malaria, diarrhea, malnutrion, and flooding). WHO, 2004.

vs

Climate-related burden of disease

Sources:
McMichael et al; 2003
Campbell-Lendrum et al; 2004
Patz et al. 2005



GLOBAL WARMING: the largest ethical problem today?

CO_2 emissions

vs

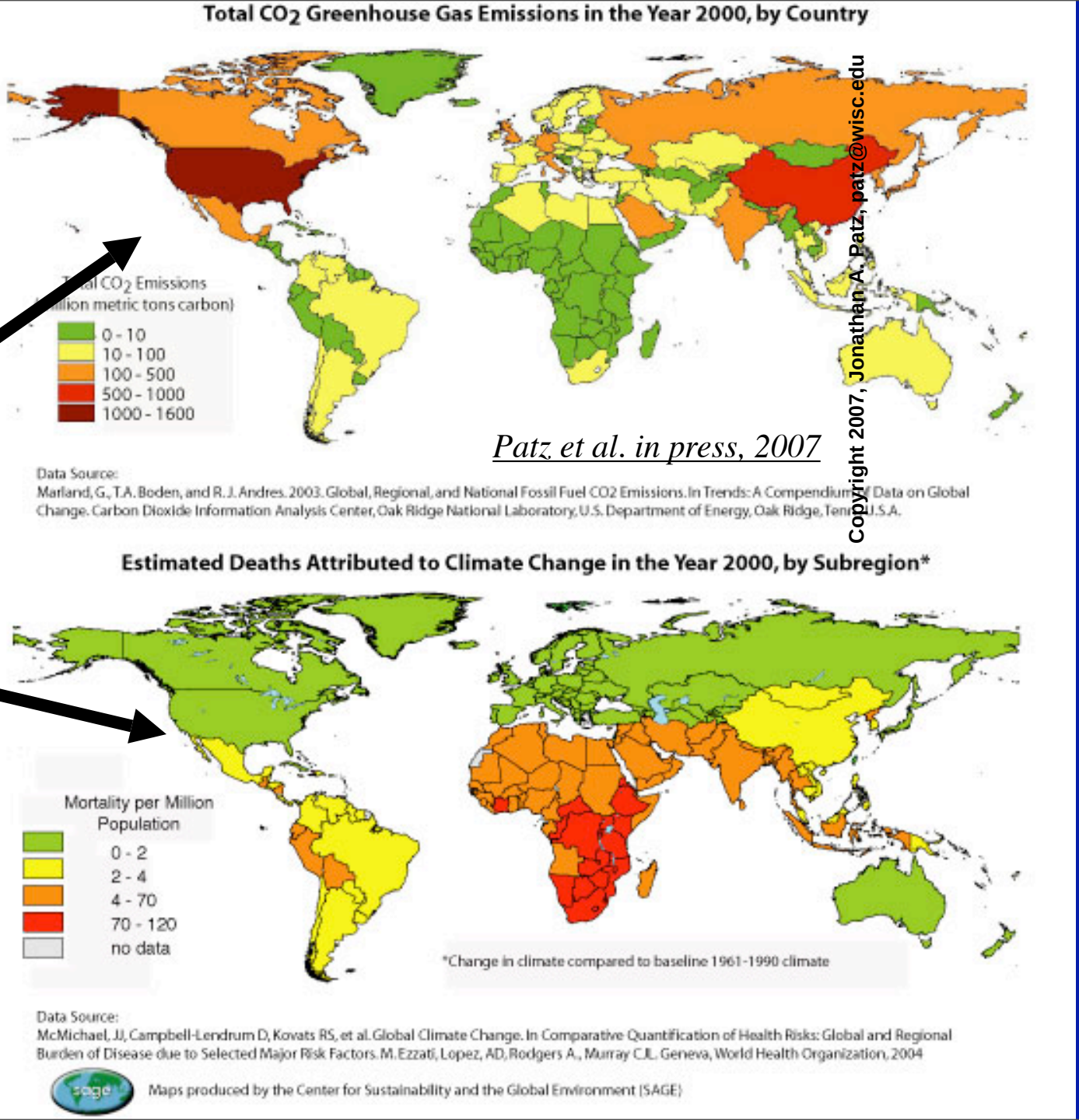
Climate-related burden of disease

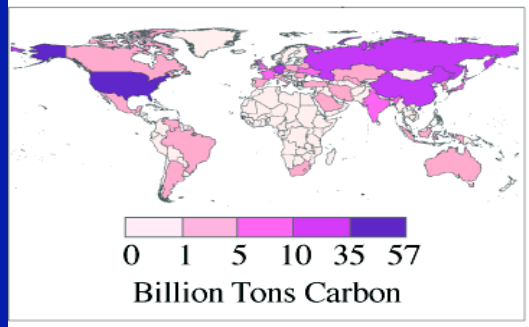
Sources:

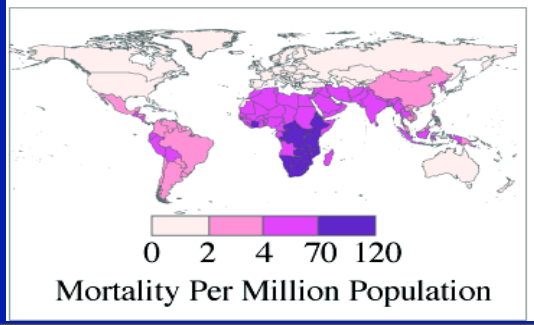
McMichael et al; 2003

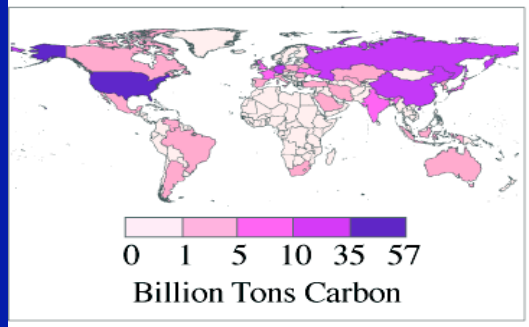
Campbell-Lendrum et al; 2004

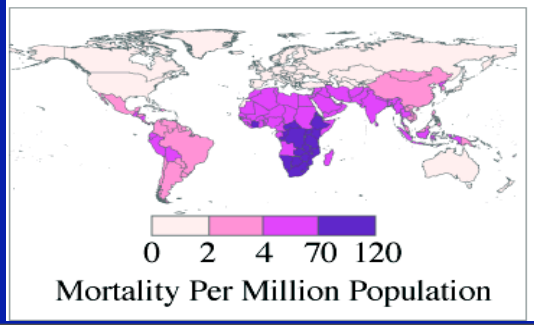
Patz et al. 2005











Patz et al., to be released next week

Key reason for banning smoking. Shouldn't we consider climate change in the same way?

"GROWING FUEL: *The Wrong Way: The Right Way*"

October, 2007, National Geographic

Source: National Geographic

Biofuels and Food Security

- Food aid shipments from the USA are inversely correlated to commodity prices

(Naylor et al. 2007)

- For 1% increase in the real prices of staple foods, 16 million more people could become food-insecure

(Runge, 2003)

Status of Americans

- ≈ 2/3 U.S. adults ≥ 20 are overweight or obese
- ≈ **15 %** of children and adolescents age 6-19 are overweight (CDC 2004).
- 20.8 million people have diabetes (7% of the population) (CDCP 2005)
- **60%** of American adults do not meet recommended levels

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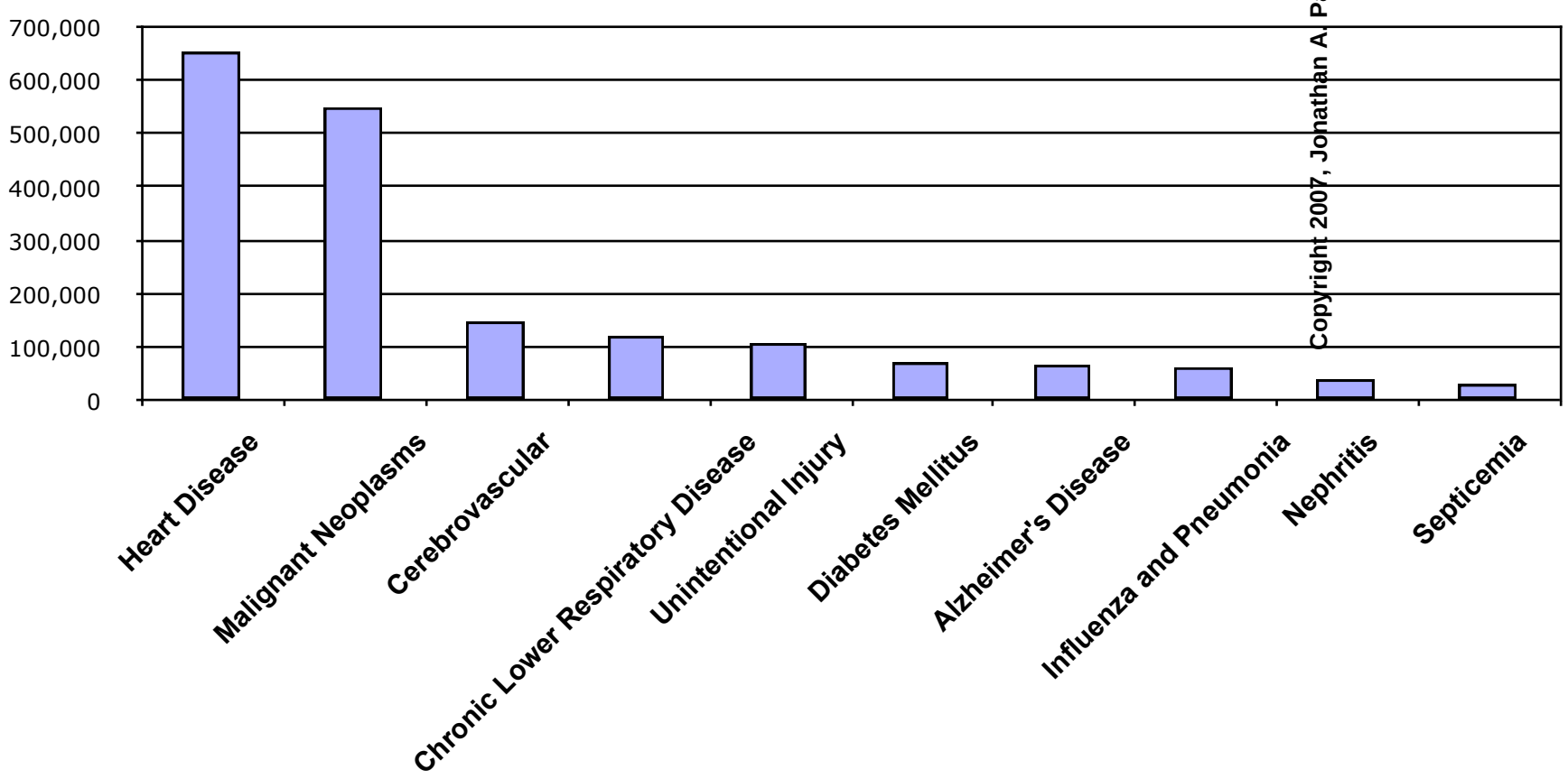
40% of trips by car are < 2 miles

(Dept of Transportation)

Ten Leading Causes of US Deaths per Year (CDC 2004)



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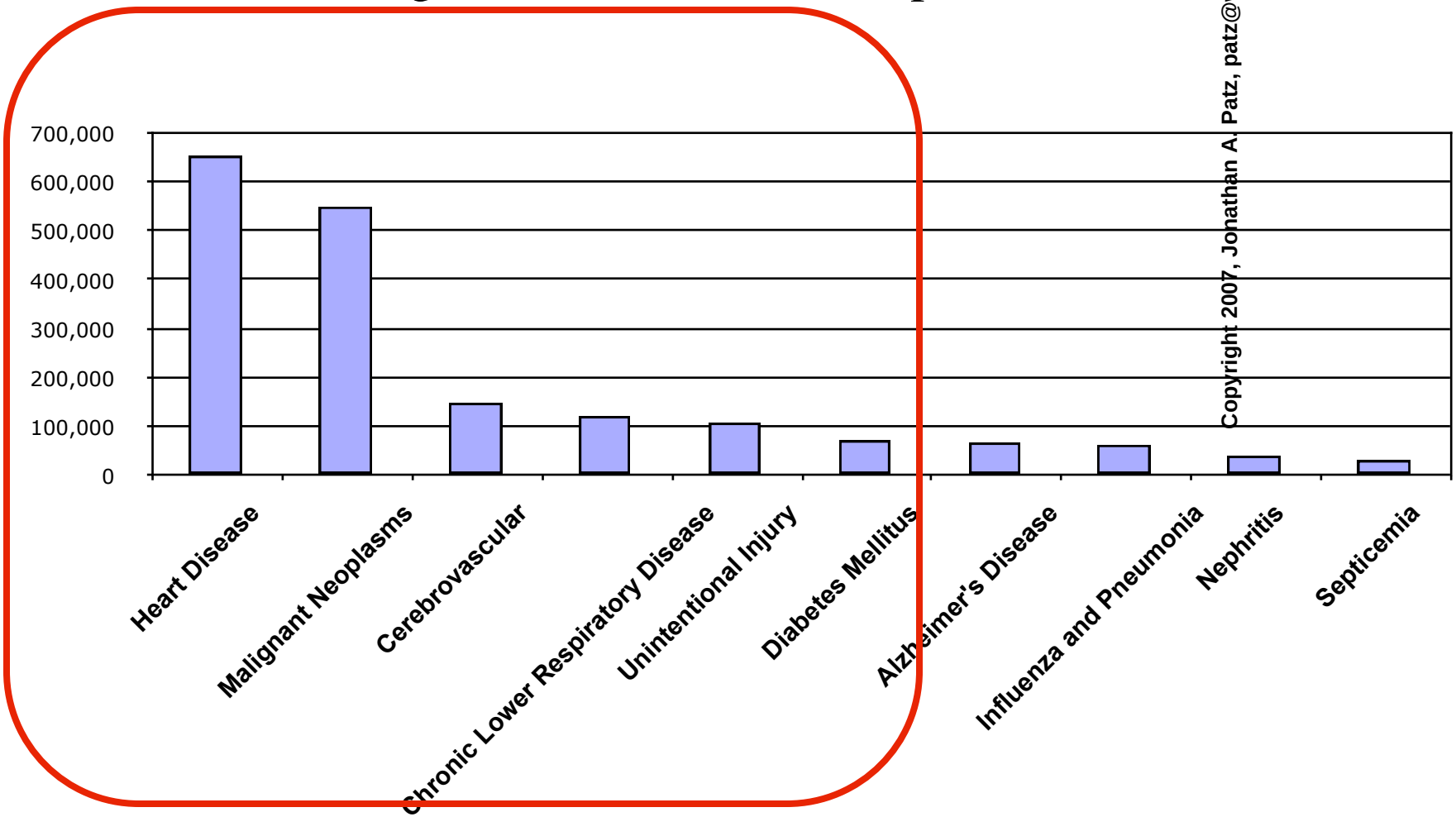

Triple Win Bike Project

1. **Health** *(personal)*
2. **Local Air Pollution** *(local)*
3. **Global Climate Change** *(global)*

Triple Win Bike Project

…Why global climate change could be the **greatest public health *opportunity*** we've had in over a century!

For Madison, **if 20% of car trips were replaced by bike trips:**

Grabow et al, in preparation

1. **10 lbs (4.5 kg) lost /person/yr** (for 6.8 mi. roundtrip commute)

2. **12% fall each in Ozone and NOx : 2% drop in $PM_{2.5}$**
3. **17,990 fewer lost-work days/yr**
4. **1,906 fewer Asthma admisisons/yr**
5. **14,586 fewer acute respiratory cases/yr**
6. **$40 million saved in health costs/yr**

3. **16,687 tons of CO_2 not emitted**

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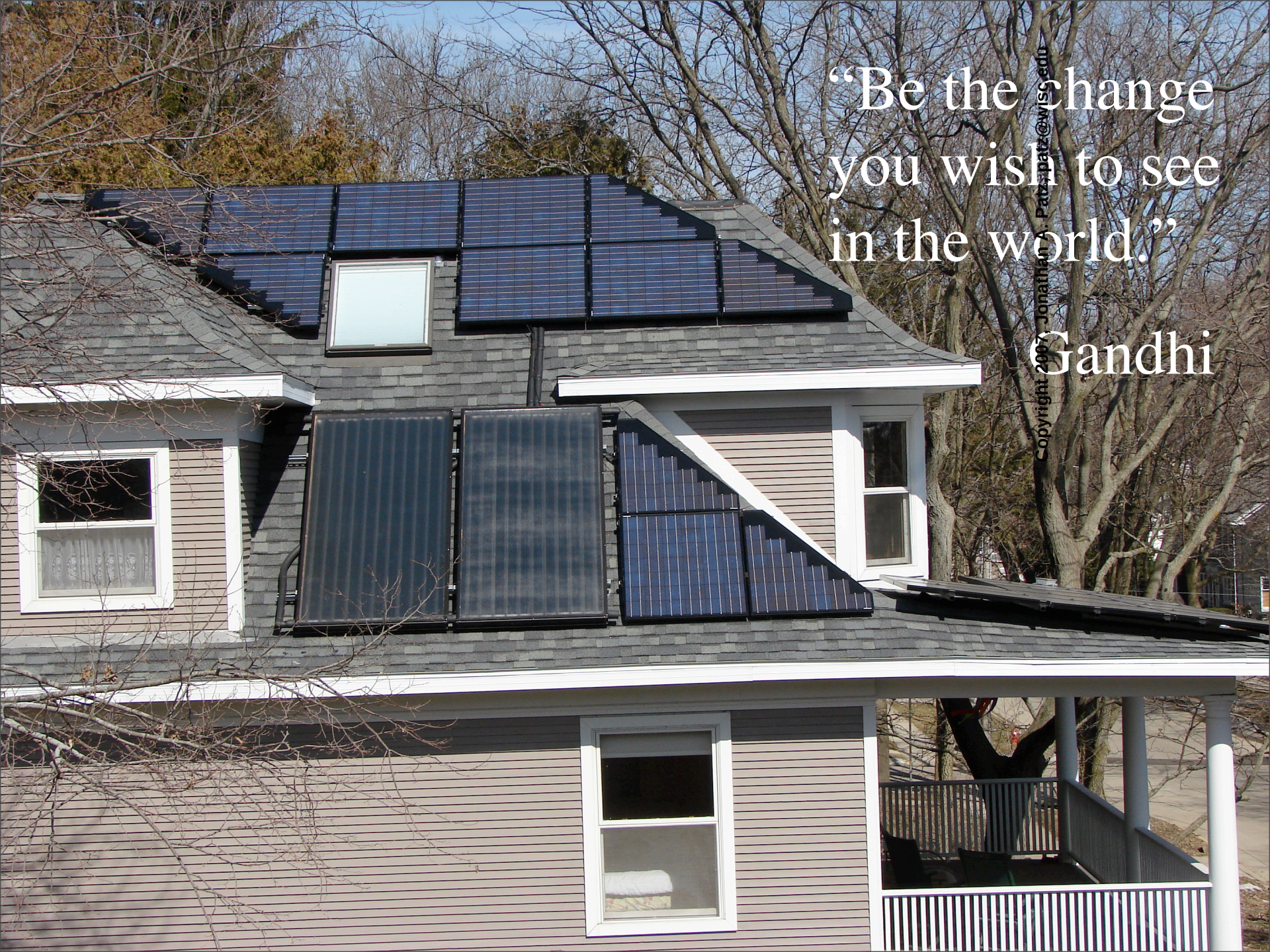
The Triple Win


“Be the change you wish to see in the world.”
Gandhi
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Information for middleschool teachers, students, and the general public

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