

What Does Climate Change Mean for Public Health?

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Intergovernmental Panel on Climate Change

By 2100:

- Higher temperatures: 2 to 11.5 °F rise by 2100
- Increase in weather extremes
- Rising sea-levels: 7 to 23-inch increase by 2100 (excluding future rapid dynamical changes in ice flow)

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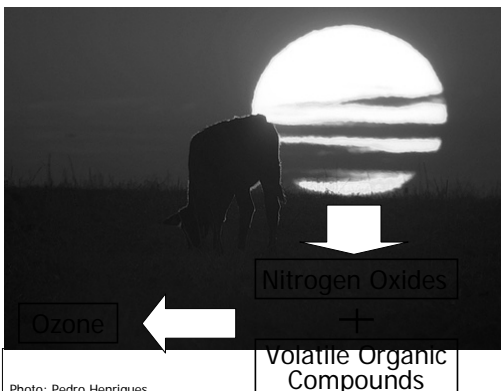
Climate Change and Public Health

- More heat-related illness
- Worsening air quality
- Rising sea levels
- More accidents and injuries from increased flooding, storm surge, and extreme weather
- Greater risk of infectious diseases
- Threatened food supplies
- Threatened quantity and quality of water supplies
- Threats to global security
- Stressed ecosystems, potential for collapse, and loss of ecosystem services

Heat Stress: Some Populations Are Particularly Vulnerable



Heat Worsens Ozone Air Pollution



Climate Change and Air Quality

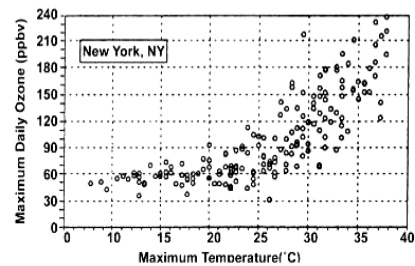
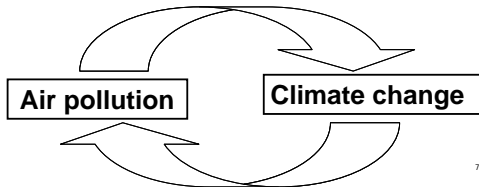


Image Source: Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change. Overview: Human Health. By the National Assessment Synthesis Team, US Global Change Research Program. Published in 2000; updated 12 October, 2003

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Health Effects of Ground-level Ozone

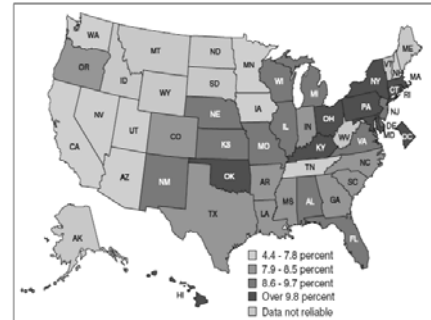
- Increased risk of hospital admissions and ER visits for people with asthma
(Friedman et al, JAMA, 2001, 285:897-905)
- **3X greater risk of DEVELOPING asthma**
(McConnell et al, Lancet, 2002, 359: 386-391)



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Annual Average Asthma Prevalence Among Children 0-17 Years from 2001-5

Maryland
10.8%, 4th
highest in U.S.



CDC Advance Data No. 381, Revised 12/29/2006

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What's the difference between the ozone "hole" and ozone pollution?

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More Extreme Weather Events



Hurricane Floyd, photo by Liz Roll/FEMA News Photo

Photo courtesy FEMA

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Health Effects of Floods

- Cause injuries and deaths
- Long term psychological and physical effects
- Increased risk of infectious disease
- Mold
- Contaminate water supplies



New Orleans, Louisiana after Hurricane Katrina

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How Does Climate Change Affect Water Supplies

- Changing precipitation patterns
- More precipitation expected to fall as rain instead of snow
- Reduced snowpacks, which release water slowly throughout the summer
- Earlier melting of snowpacks → flooding, low flows in late spring and summer when irrigation demands peak
 - Snowpacks in Cascade mountains in OR, WA drop by 60% reducing summer stream flows by 20-50%
- Glaciers melting (Alps, Andes, Himalayas)

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How Bad is the Water Problem?

- 1/3 of the world's population, about 2 billion people, currently lives in water-stressed countries (UNEP, IPCC)
- By 2025, that number is expected to increase to 5 billion (UNEP, IPCC)
- Nearly 1/3 of the world's land surface may be at risk of extreme drought by 2100. (Burke et.al. Journal of Hydrometeorology, Sept. 2006)



Women queue for water near Moyale in the lowlands of Ethiopia's Oromiya region.

Health Effects of Droughts



- Concentrate micro-organisms and contaminants in water supplies
- Crop failures
- Water shortages for hygiene
- Increase risk of forest fires
- Increase risk of infectious disease (i.e. West Nile virus)

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Sea-Level Rise



Baltimore, Maryland after Hurricane Isabel. September 2003

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Health Effects of Sea-Level Rise

- Inundation of living areas; expansion of flood plains
- Erosion and loss of coastal land
- Contamination of fresh water
- Population displacement
- Loss of critical infrastructure

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- Bangladesh stands to lose ~15% of land mass with 1 meter sea level rise
- Compromising >10% of food production
- Per UNEP/WB 10 "poor countries" that would be severely impacted by sea level rise:

Bangladesh	Benin
Guyana	Surinam
Guinea-Bissau	Egypt
Mauritania	Gambia
Vietnam	Sri Lanka



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An Equation for Disaster

- + Forced migration of millions of people
- + Scarce resources
- + Already stressed infrastructures

= **Conflict**

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Infectious Disease: Dengue Risk



- In 1990, almost 30% of the world population, 1.5 billion people, lived in regions where the estimated risk of dengue transmission was >50%
- In 2085, an estimated 50-60% of the projected global population, 5-6 billion people, would be at risk of dengue transmission, compared with 35% (3.5 billion) if climate change didn't happen.

Hales, de Wet, Maindonald, Woodward, *The Lancet*, 2002, 360:830

Food Supply: Effects of Climate Change on Crop Production

Direct Effects:

- **CO₂ levels increasing**
 - Good for some crops in short-term
- **Temperature increasing**
 - Revised hardiness zone map, many areas will jump a zone up
 - Heat waves & droughts caused massive crop and livestock losses in Midwest and California past 2 years
- **Precipitation patterns changing**
 - More precipitation coming in form of extreme weather events leading to greater runoff and erosion as well as water shortages
 - More droughts and floods

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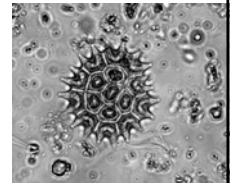
Food Supply: Indirect Effects of Climate Change

- **Plant pests and diseases**
 - Longer growing seasons mean some pests can squeeze in an extra reproductive cycle
 - Winter temperatures lower, does not kill or suppress pests as well
- **Salt contamination** of soils and wells from sea level rise and extreme weather
 - Hurricanes, for example, have salt-laden winds and spray that blow far inland and deposit salt on plants and soils
- **Ozone poisoning**

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What About the Marine Food Supply?

- Phytoplankton are base of oceanic food chain
- Their growth rate ultimately controls the biomass that the oceans can support
- Basic materials needed by phytoplankton are sunlight, water, inorganic nutrients
- As sea surface temperature ↑, net phytoplankton production ↓



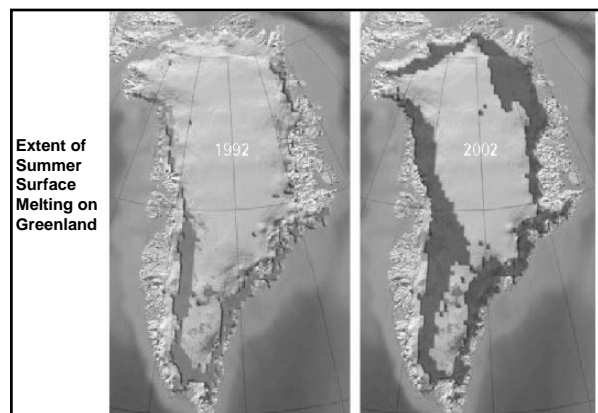
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Environmental Protection Agency

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Potential Mechanisms for Abrupt Climate Change

- Melting arctic
 - Less ice and snow to reflect sunlight
 - Potential for large releases of methane

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Extent of Summer Surface Melting on Greenland

Arctic Impacts of Arctic Warming, Cambridge Press, 2004

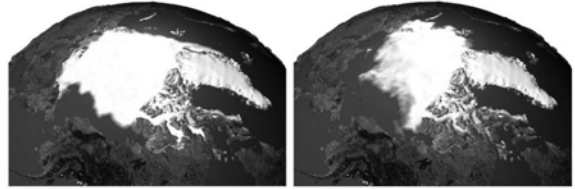
Surface Melt on Greenland

Melt descending into a moulin, a vertical shaft carrying water to ice sheet base



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Arctic Sea Ice



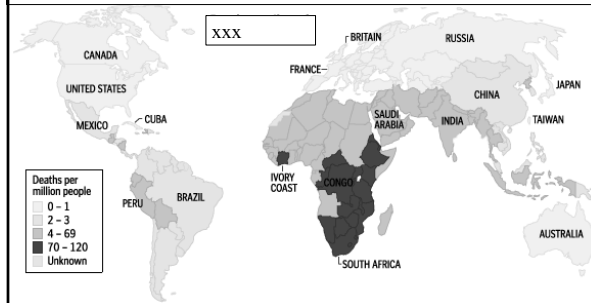
NASA

Observed September 1979

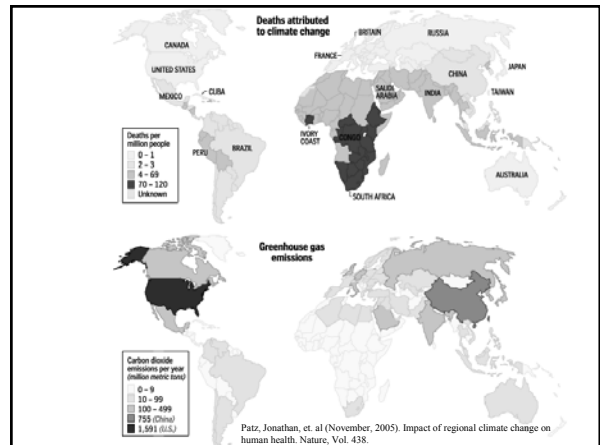
Observed September 2003

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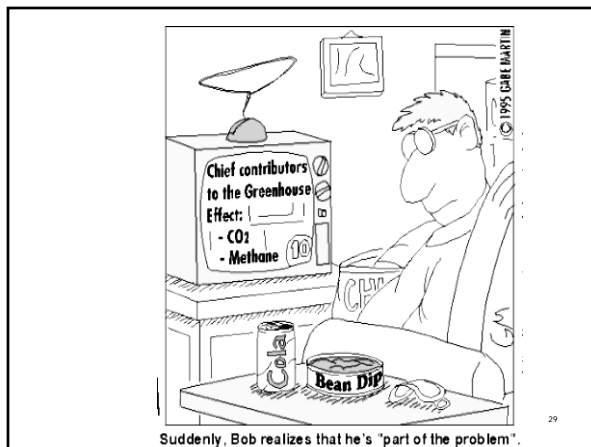
Deaths Attributed to Climate Change NOW 150,000 per year



Patz, Jonathan, et. al (November, 2005). Impact of regional climate change on human health. Nature, Vol. 438. 27



Patz, Jonathan, et. al (November, 2005). Impact of regional climate change on human health. Nature, Vol. 438.



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'If we do not change direction, we are likely to end up exactly where we are headed'



- Chinese proverb

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What Do We Need to Do?

- Stabilize CO₂ at 450* ppm by 2050 to avoid *dangerous* climate change (<2°C)
- CO₂ emissions have been increasing at ~2%/year, therefore our CO₂ emissions must level out by 2020 and decline 80% below 2006 levels by 2050
- We have less than 10 years to make big changes in how humans behave (2004)

Global Warming Solutions Act

*currently at 380 ppm

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Environment Maryland. www.environmentmaryland.org

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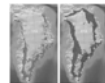
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Arctic Climate Impact Assessment. Impacts of Arctic Warming. New York: Cambridge Press, 2004. All Rights Reserved.

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WHO World Health Report 2002.



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