Air Pollution and Respiratory Health

Brian Urbaszewski
Respiratory Health Association
July 21. 2018

RESPIRATORY HEALTH ASSOCIATION®

RESPIRATORY HEALTH ASSOCIATION®

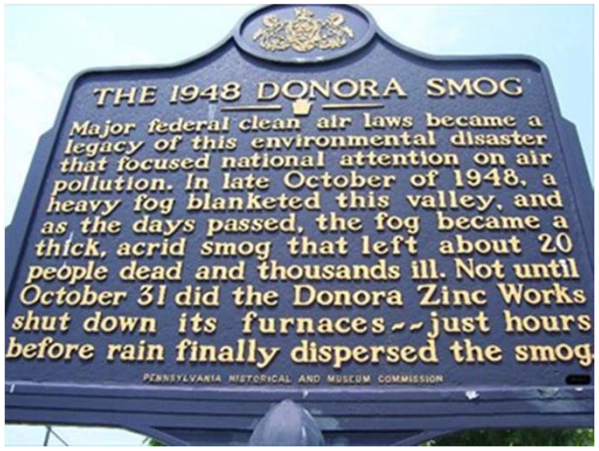
- Founded 1906 in Chicago
- Mission – **Prevent lung disease, promote clean air and help people live better through education, research, and policy change.**
- Means... fighting air pollution, defending the Clean Air Act, and working to promote strategies to clean the air.

Steve, Kari & Their Building

So What IS ‘Air Pollution’?

- Working definition...
- ***Presence of a substance(s) in the air at a concentration sufficient to interfere with health, comfort or safety, or with the full use and enjoyment of an area.***
- Flying rocks, sandstorm, etc. all the way to greenhouse gases...

Donora 1948



THE NEW YORK TIMES, SUNDAY, OCT

EHEARSALS

"Otello" on
fe yesterday
ew York Times

DONORA, PA., 'SMOG' CITED IN 18 DEATHS

Continued From Page 1

oxygen tents in operation tonight, compared to our usual three. So far, however, we've been lucky—none of the deaths has occured at the hospital."

Mrs. Vernon said the American Legion is cooperating in taking patients to the emergency hospital. Most are receiving injections of adrenalin, she added.

Dr. Lau said the smoggy conditions had been prevalent throughout the district, which is heavily industrialized. Donora is about thirty miles south of Pittsburgh. In that big steel center considerable smog has been noted in the past few days, but experts say recent smoke control measures have reduced the smog's intensity.

Lasting friendships are made in the Army. Travel, security and financial independence go hand-in-hand with an enlistment in the new Regular Army. Your nearest Army recruiting station has complete details. There's an Army recruiting station at 39 Whitehall Street.

BABYLON PLAN

**Preparations for Vi
Tulip Festiva**

Special to THE NEW

BABYLON, L. I.,
ert Moses, presiden
Island State Park C
sisted this morning
first of 52,000 tulip
grounds in the villa
in preparation for
nual tulip festival s
service organizatio
lage. Members of th
and Street Depart
continued the plant
day.

Funds for bulbs
from a concert by
Band two weeks a
10,000 bulbs wer
Mayor Erastus E
new bulbs were pl
Argyle Park, at
ways and at the
ings.

Last year's bulb
on the north side
In addition to the
village thousands
planted on the
Parkway by the L
Park Commission.

The festival is
tract attention to
center of the bul
try in this part

Los Angeles - late 1950's

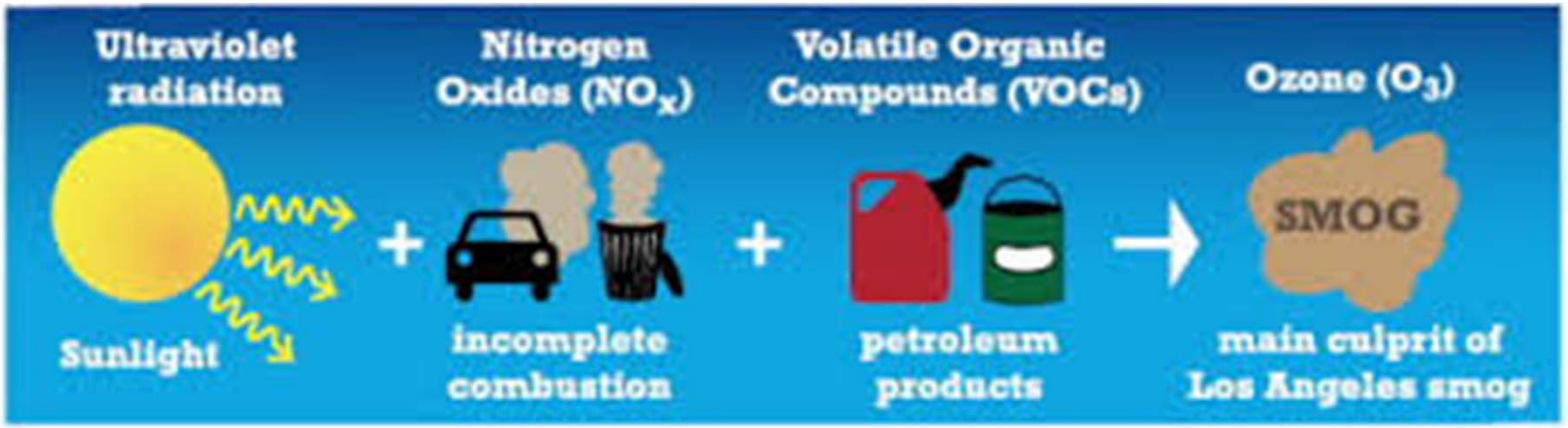
So how pollution tracked today?

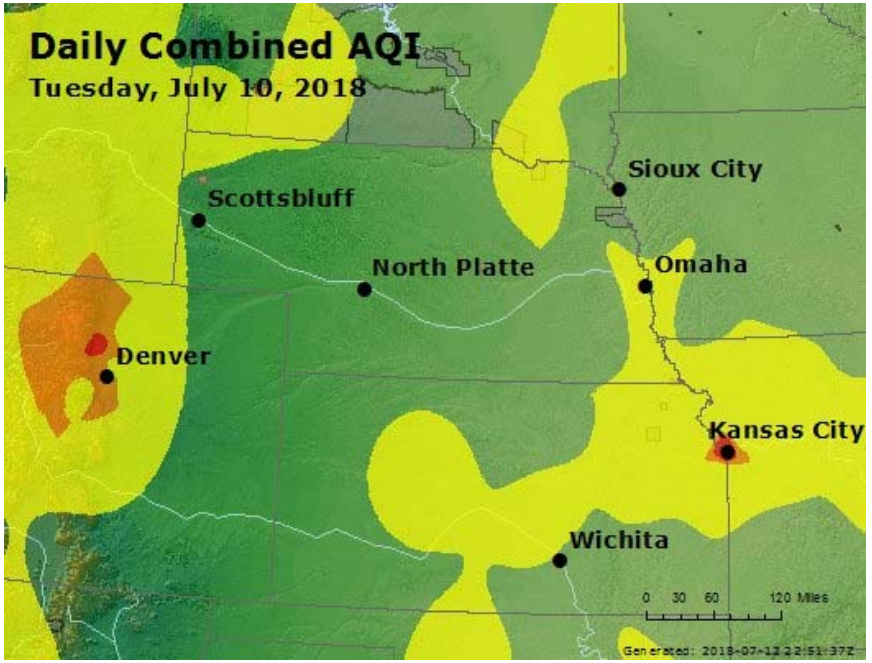
- Focus on the main six pollutants in Clean Air Act (1970-)
- Criteria pollutants
  - **Carbon Monoxide**
  - **Lead (unleaded gasoline ...)**
  - **Nitrogen Dioxide**
  - **Sulfur Dioxide**
  - **Particulate Matter**
  - **Ozone**
- EPA calls them CRITERIA Air pollutants because....
  - "it regulates them by developing human health-based and/or environmentally-based criteria (science-based guidelines) for setting permissible levels. "

MORE…

- CAA, federal health standards for top 6.
  - 'To protect health with reasonable margin of safety'
- Idea: measure air quality, see if too high.
  - If it is then process goes in motion to clean up…
- Standards tightening as medical science shows health effects at ever lower concentrations.
  - Re-evaluation every 5 years = huge legal fights.
  - But CAA says standard set based on science - Period.
- ***Generally…* 4 challenges remain**
  - **Ozone, PM2.5, sulfur dioxide, lead**

Making Ozone (Smog)





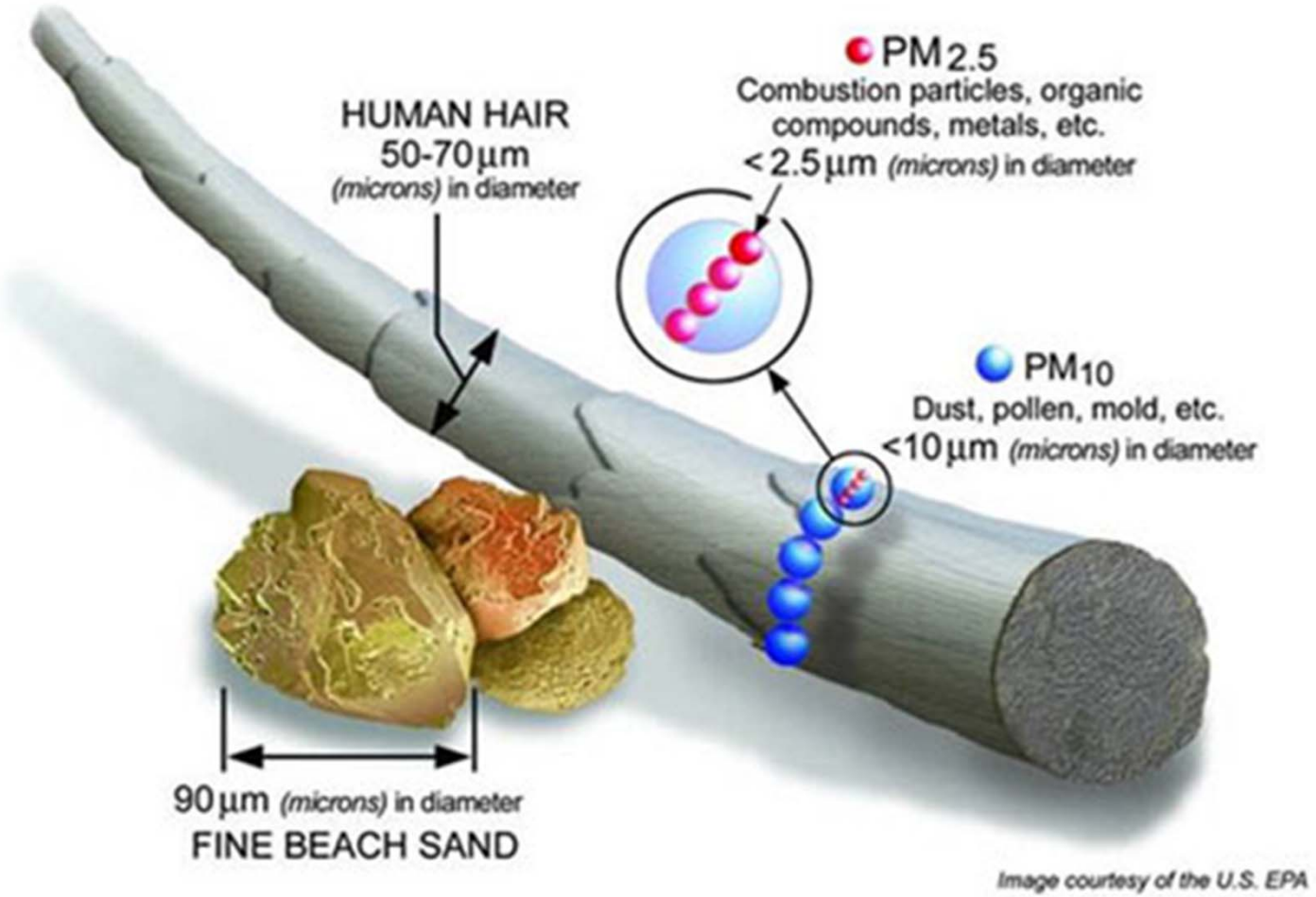
Ozone - Health Effects?

- Caustic gas, burns or ‘oxidizes’ lung tissue
- Irritation/swelling, body’s attempt to repair damage
  - ‘sunburn on the inside of your lungs’
- Symptoms?
  - Difficulty/discomfort breathing, chest pain, coughing, etc.
- Results of breathing ozone?
  - More asthma attacks, more respiratory ER visits + hospital stays
  - Ballpark 4000 deaths nationally/year
  - Lower resistance to infection, more sickness, lost work/school days

Particulate Matter

Particulate Matter ($PM_{2.5}$)

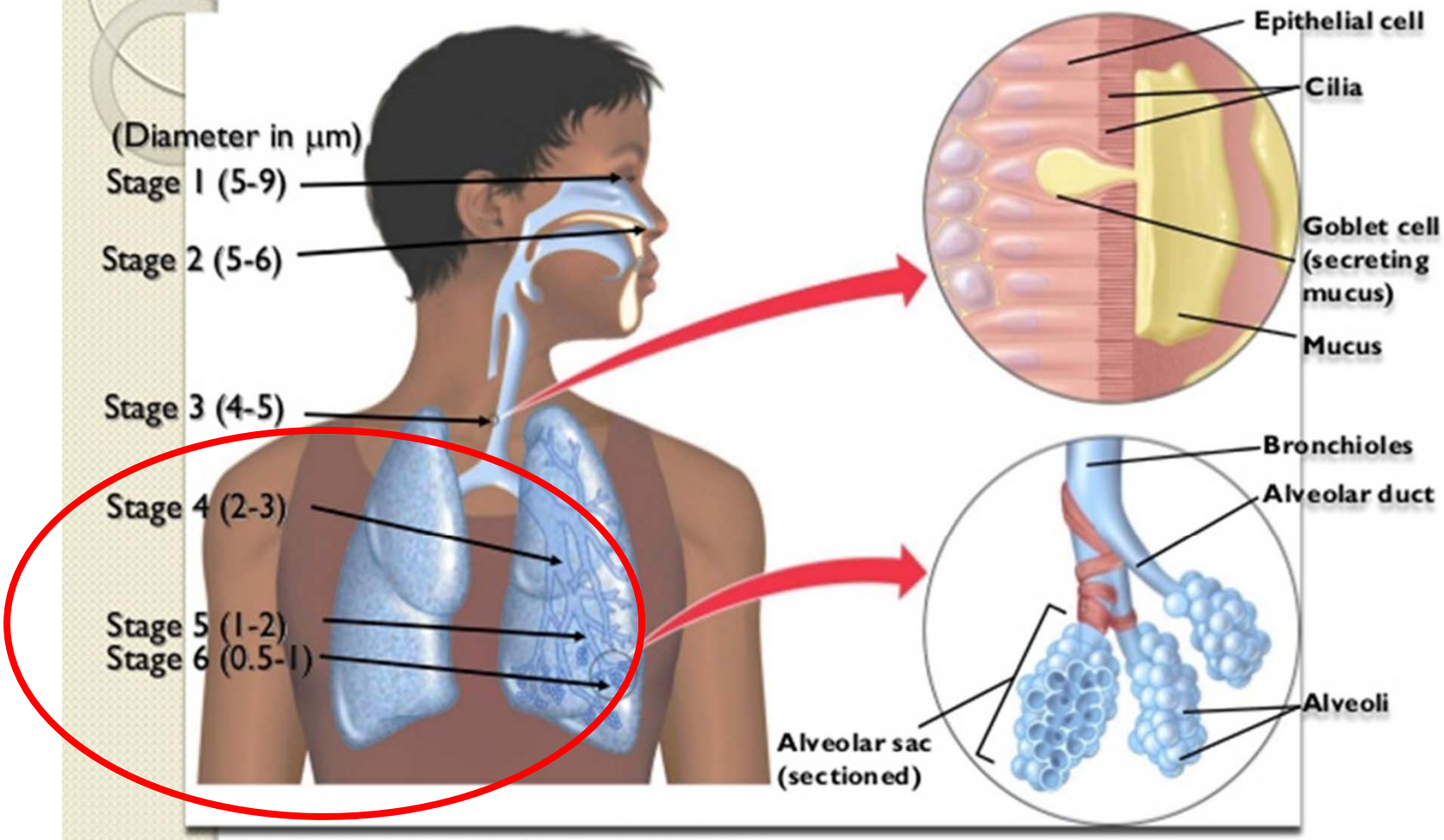
- Basically ‘soot’ particles, but complicated



Particulate Matter ($PM_{2.5}$)

- Some particles emitted directly
  - E.g. coal ash, diesel engine soot, dirt/salt, smoke
- Some particles emitted as gas, turn into particle while on the wind. (#magic)
  - NO_2 gas/nitrate particles
  - SO_2 gas/sulfate particles
- Gases can travel hundreds of miles
- **In most areas (esp. eastern U.S.) this 'secondary' $PM_{2.5}$ is dominant source**

PM and Their Targets



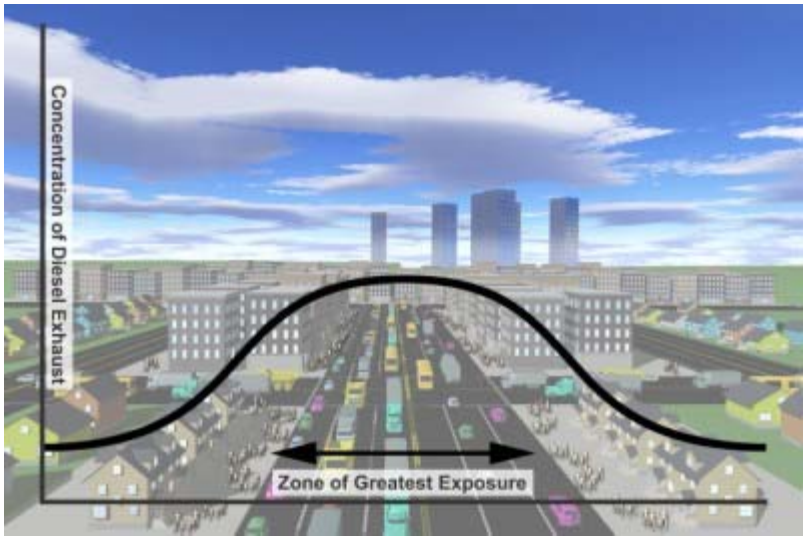
Major components of respiratory system

Health Impacts $PM_{2.5}$

- **Smaller the particle = more deadly**
- Size of particles important – not necessarily just the material!
- Results? Asthma Attacks, Resp. Emergency room visits/hospitalizations, heart stoppages, stroke, premature deaths.
- 10,000's deaths/year in U.S.
- **Only point you get zero health impacts from $PM_{2.5}$ is when you breathe no $PM_{2.5}$**

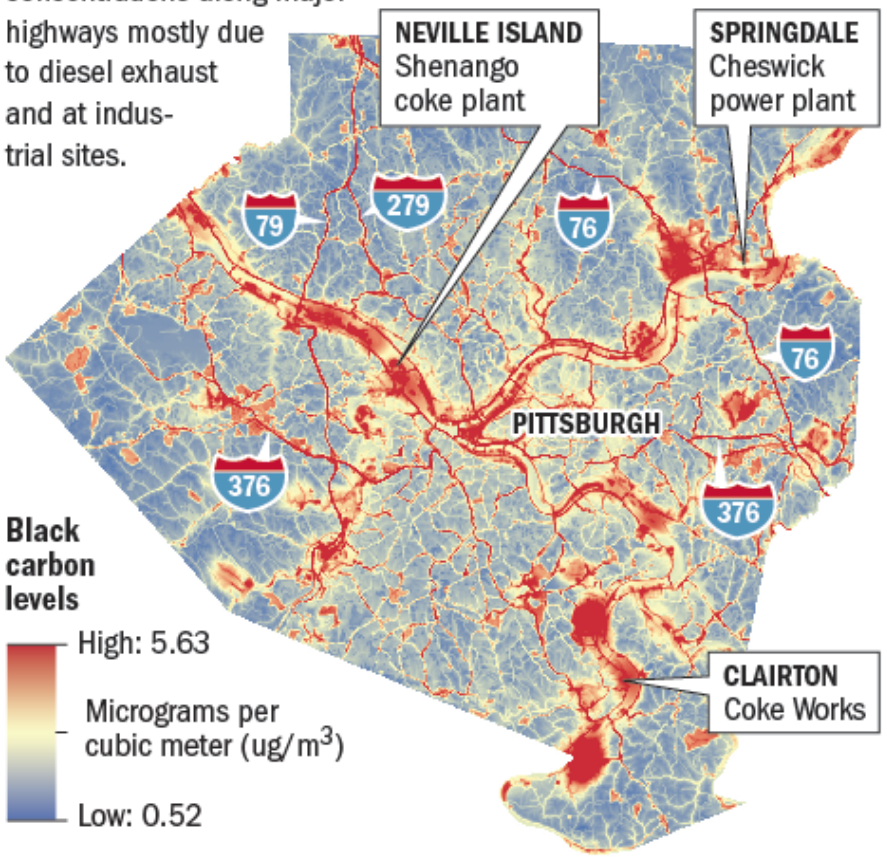
NEAR Traffic = MORE Diesel PM

MORE Trucks = MORE Diesel PM



Black carbon pollution readings

Albert A. Presto's pollution map shows levels of black carbon, a component of particulate matter (PM2.5) county-wide, with higher concentrations along major highways mostly due to diesel exhaust and at industrial sites.

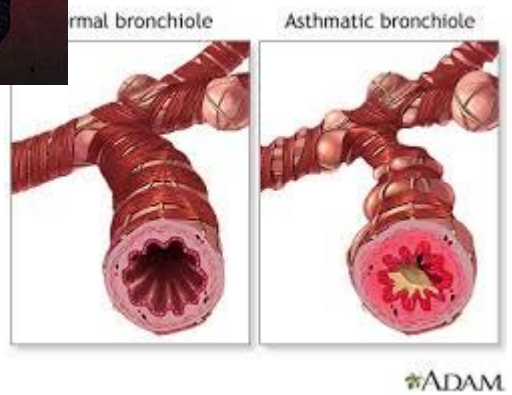


Source: Center for Atmospheric Particle Studies, Carnegie Mellon University

Post-Gazette

Health effects – Ozone & PM2.5

- Asthma attacks
- ER visits
- Hospitalizations
- Heart attacks
- Premature deaths



- Lost days from work/school, medication, MD office visits, MRAD

Who's at Risk?

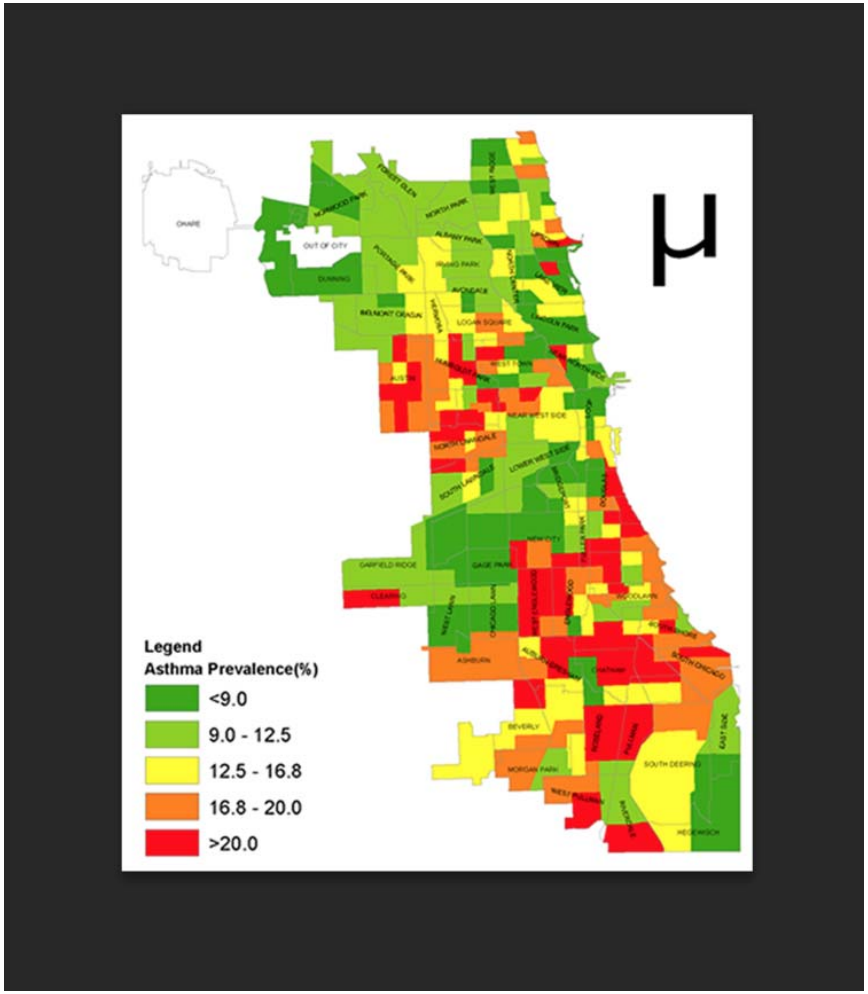
- Although exposure to air pollution is unhealthy for everyone, people with heart or lung diseases, children and the elderly are the most at risk from the health impacts of diesel pollution

Who's at Risk?

- Children are particularly vulnerable to the health impacts of air pollution because their lungs are still developing.
- Children also breathe 50 percent more air per pound of body weight than do adults, which also makes them more vulnerable.

Example: Variance - Chicago Asthma

- Chicago is known as the "epicenter" of asthma
- Asthma #1 reason for school absenteeism due to chronic condition
- In Chicago, the hospitalization rate is nearly double than average
- In some neighborhoods, over 30% of children suffer from asthma; Others <9%



MORE Who's at Risk?

Lifestyle Factors

- Driving frequently in areas with high congestion/truck traffic or riding on diesel transit buses which lack pollution controls

- **Working near diesel sources**
  - A 2008 Harvard Study found odds of dying from heart disease are nearly 50 percent higher among truck drivers than the general U.S. population

MORE Who's At Risk?

- **Living close to busy roads or highways**
  - 2007 study by German researchers found that living near an a highway or heavily traveled road is associated with increased risk of hardening of the arteries
- **People can get majority of exposure just during daily commute**

Proximity to heavy traffic	Chance of high coronary artery calcification
Within 50 meters	63%
Between 51-100 meters	34%
Between 100-200 meters	8%

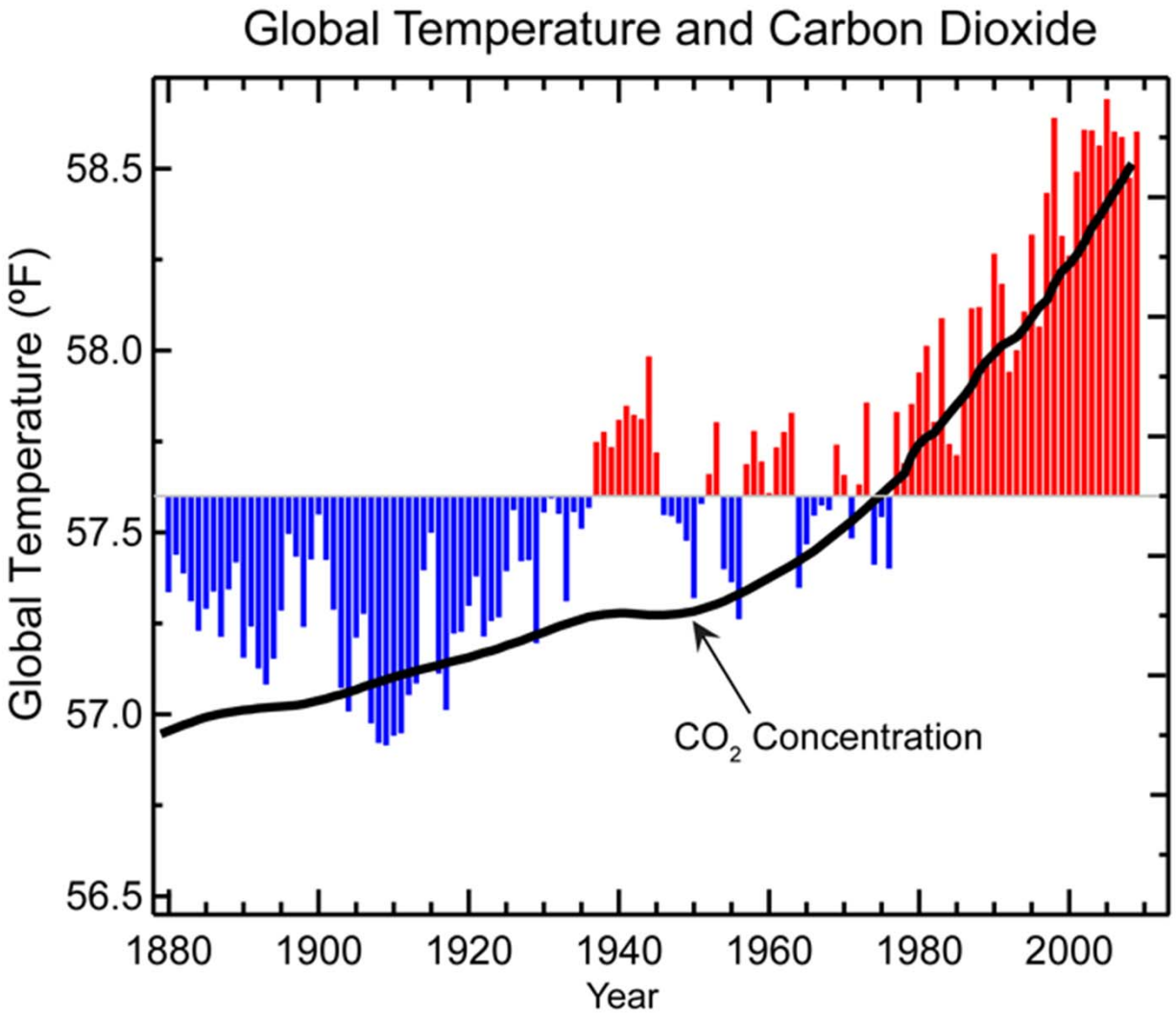
Diesel Exposure = Lung Cancer

- **2012 World Health Organization /International Agency for Research on Cancer says "diesel exhaust causes cancer"**
- 2012 Centers for Disease Control - 20 yrs, 12,000 miners.
  - Strong relationship between level of exposure to diesel exhaust and risk of lung cancer death.
  - At higher exposures to diesel exhaust, death rates were about 3 to 5 times greater compared to workers who had the lowest exposures.
  - Relationship between lung cancer risk and diesel exhaust exposure remained after controlling for smoking and other lung cancer risk factors.

World Health Organization

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

CO_2 goes up over time, temperature goes up



Kansas Typical Global Warming Images...

Extreme Weather Events

A.P. ile photo in the Chicago Tribune Aug. 25, 1995
Homewood Memorial Cemetery, Homewood IL

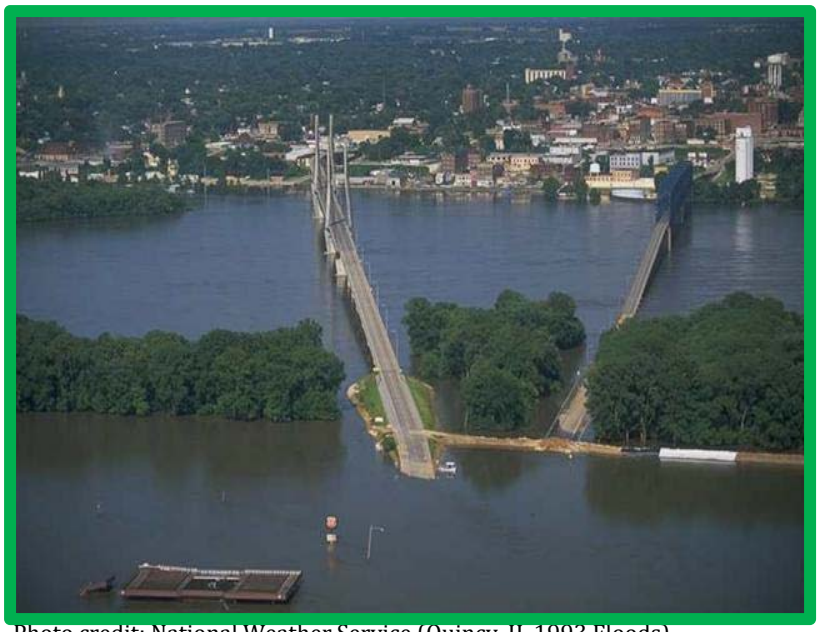
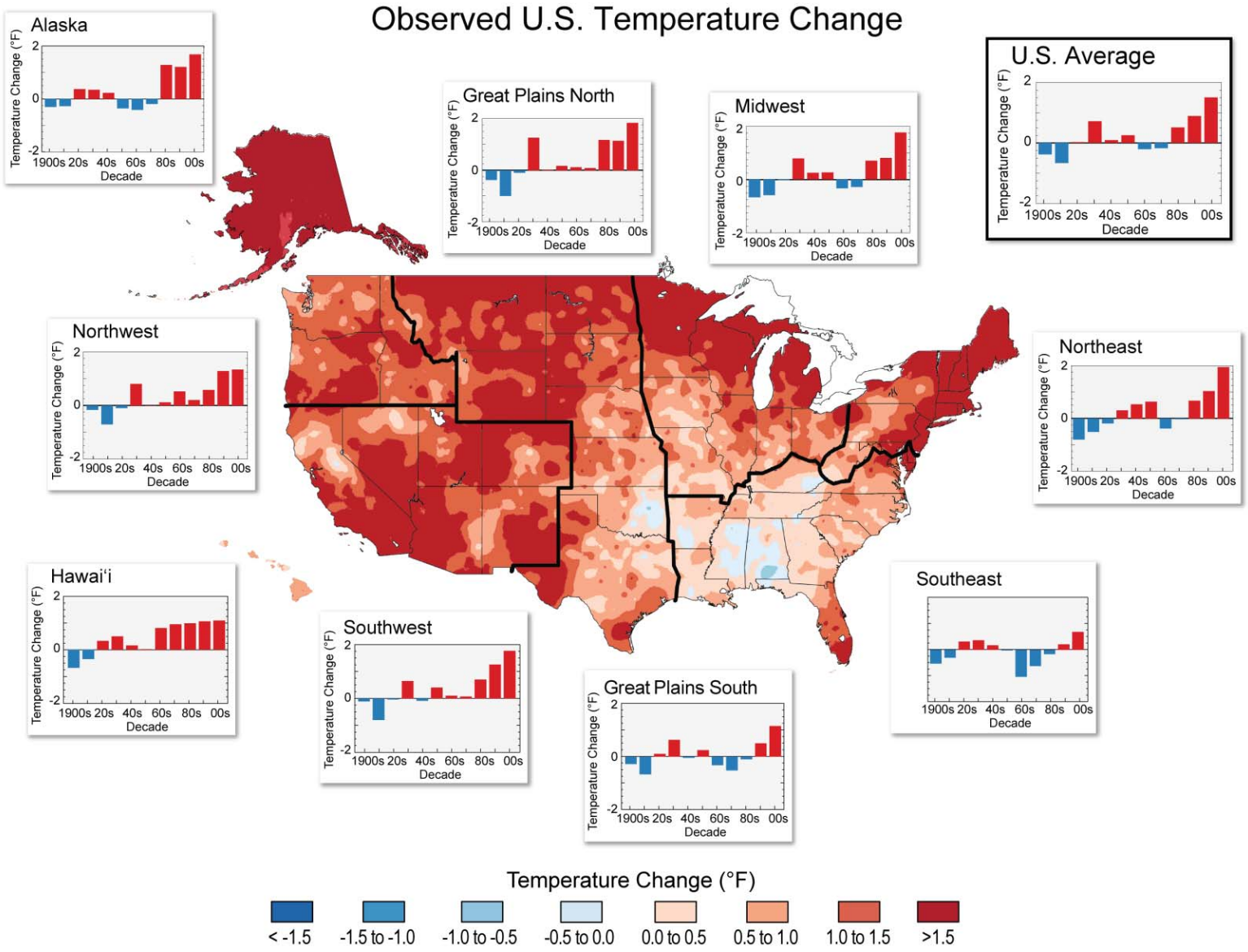


Photo credit: National Weather Service (Quincy, IL 1993 Floods)

Photo credit: Chris Walker, Chicago Tribune, April 19, 2013
Flooding in DesPlaines along the Des Plaines River

Photo credit: CNN July 25, 2012
A field of dead corn next to the Lincolnland Agri-Energy ethanol plant in Palestine, Illinois,

Observed US temperature change 1991-2012

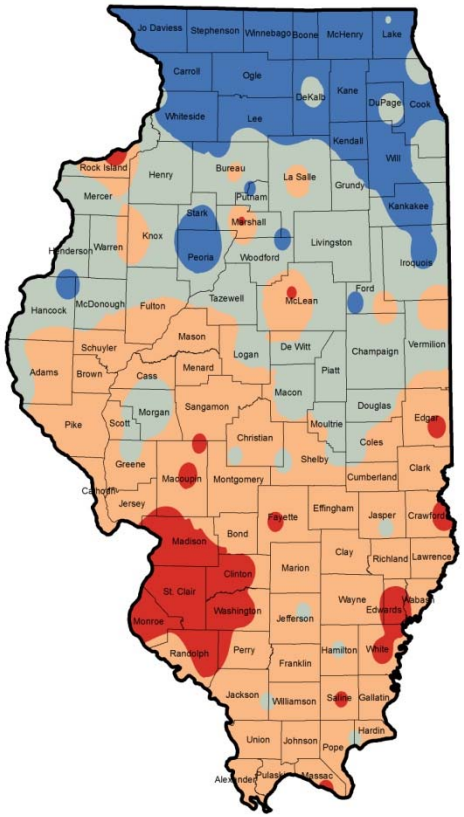


(Figure source: NOAA NCDC / CICS-NC).

HEAT?

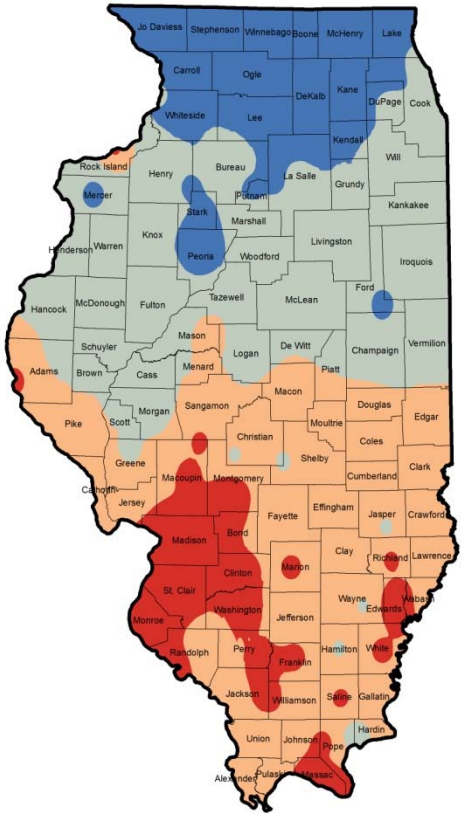
Minimum Daily Summer Temperatures Rising in IL

1980-1989



Min: 65 ^{0} F
Max: 74 ^{0} F

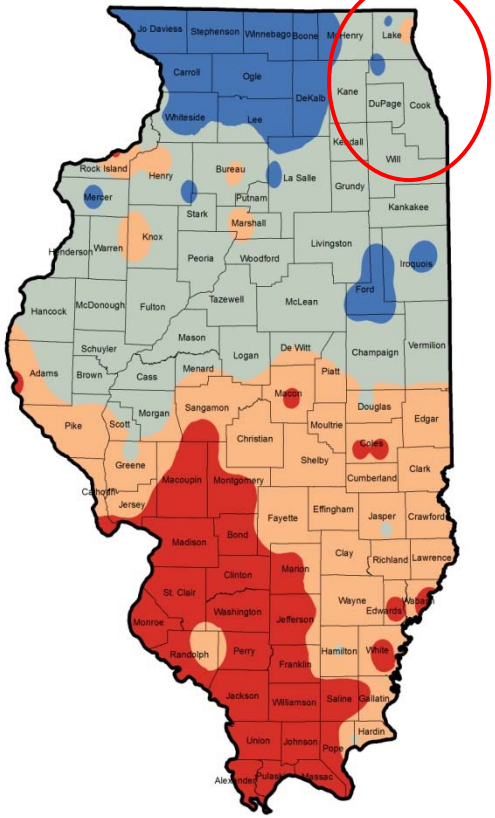
1990-1999



Min: 65 ^{0} F
Max: 74 ^{0} F

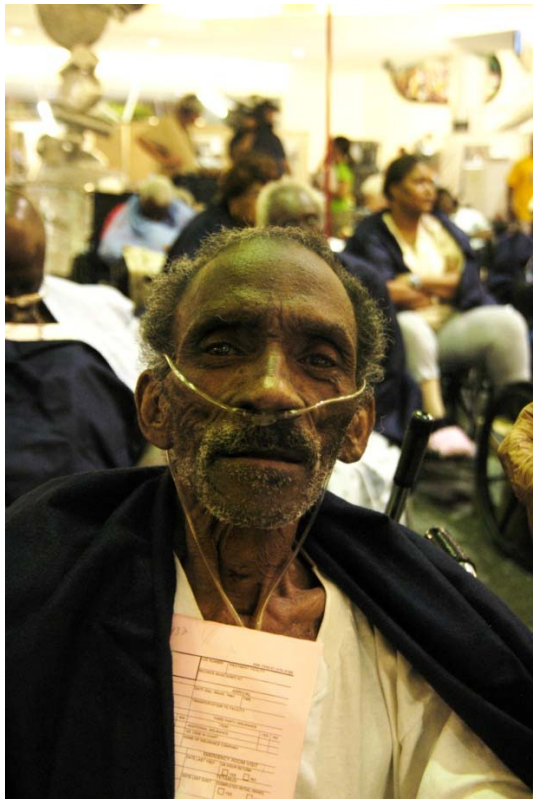
2000-2010

9M



Min: 68 ^{0} F
Max: 77 ^{0} F

Population Vulnerability: Who is at increased risk of climate/health problems?



HEAT: deadliest of all natural disasters

There are more deaths in the US each year due to **HEAT** than due to wildfires, hurricanes, tropical storms, flooding, earthquakes, tsunamis, volcanoes, avalanches, and landslides **combined**

Chicago Police officers remove the body of man from the Sutherland Hotel. Officials said the death was linked to the extreme heat. — *Tribune archive photo, July 18, 1995*

Borden and Cutter 2008

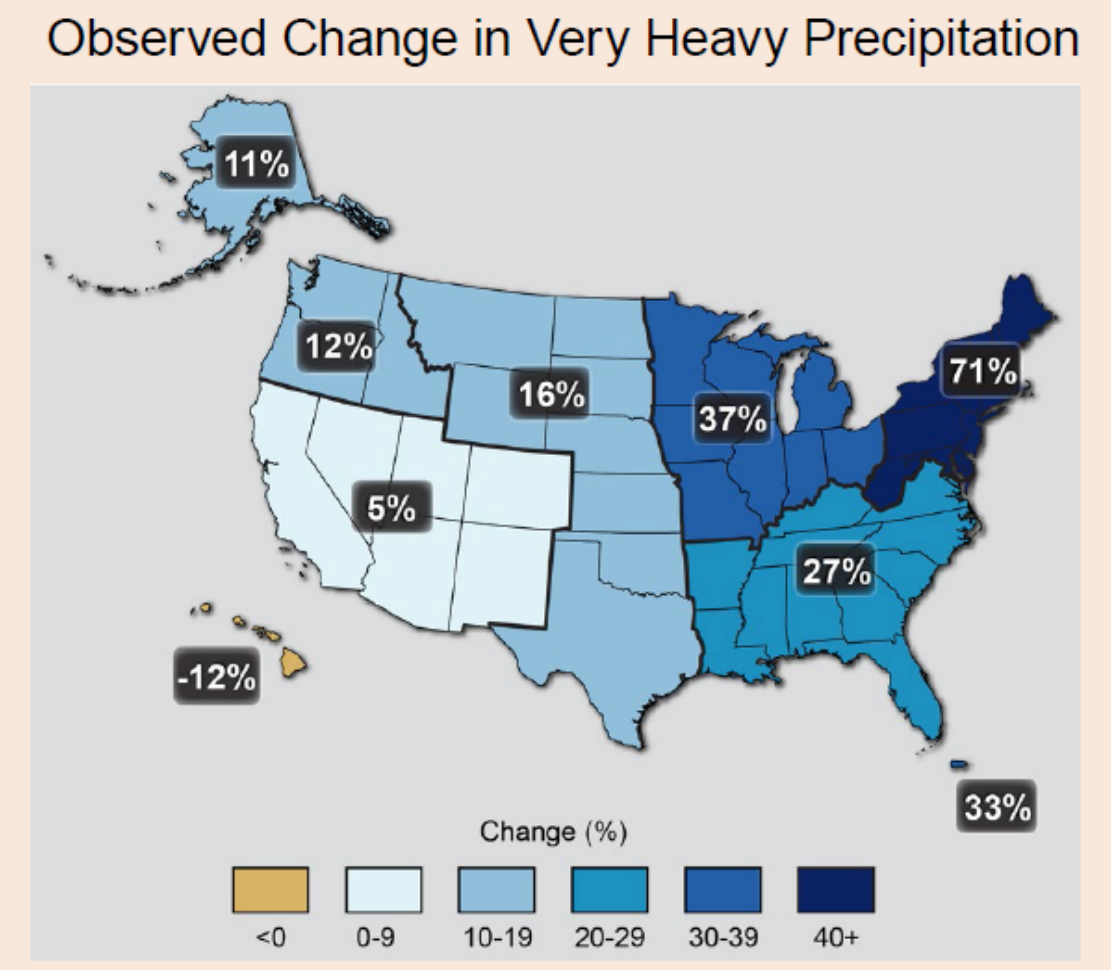
Record Heat on August 3, 2011

Site	High Temp
Fayetteville (NW AR)	110°!
Harrison (NC AR)	112°!
Mountain Home (NC AR)	114°
Jonesboro (NE AR)	107°
Fort Smith (WC AR)	115°!
Little Rock (C AR)	114°!
West Memphis (EC AR)	105°
Mount Ida (WC AR)	112°
Hot Springs (C AR)	108°
Pine Bluff (SE AR)	110°
Texarkana (SW AR)	111°
El Dorado (SC AR)	108°
Monticello (SE AR)	107°

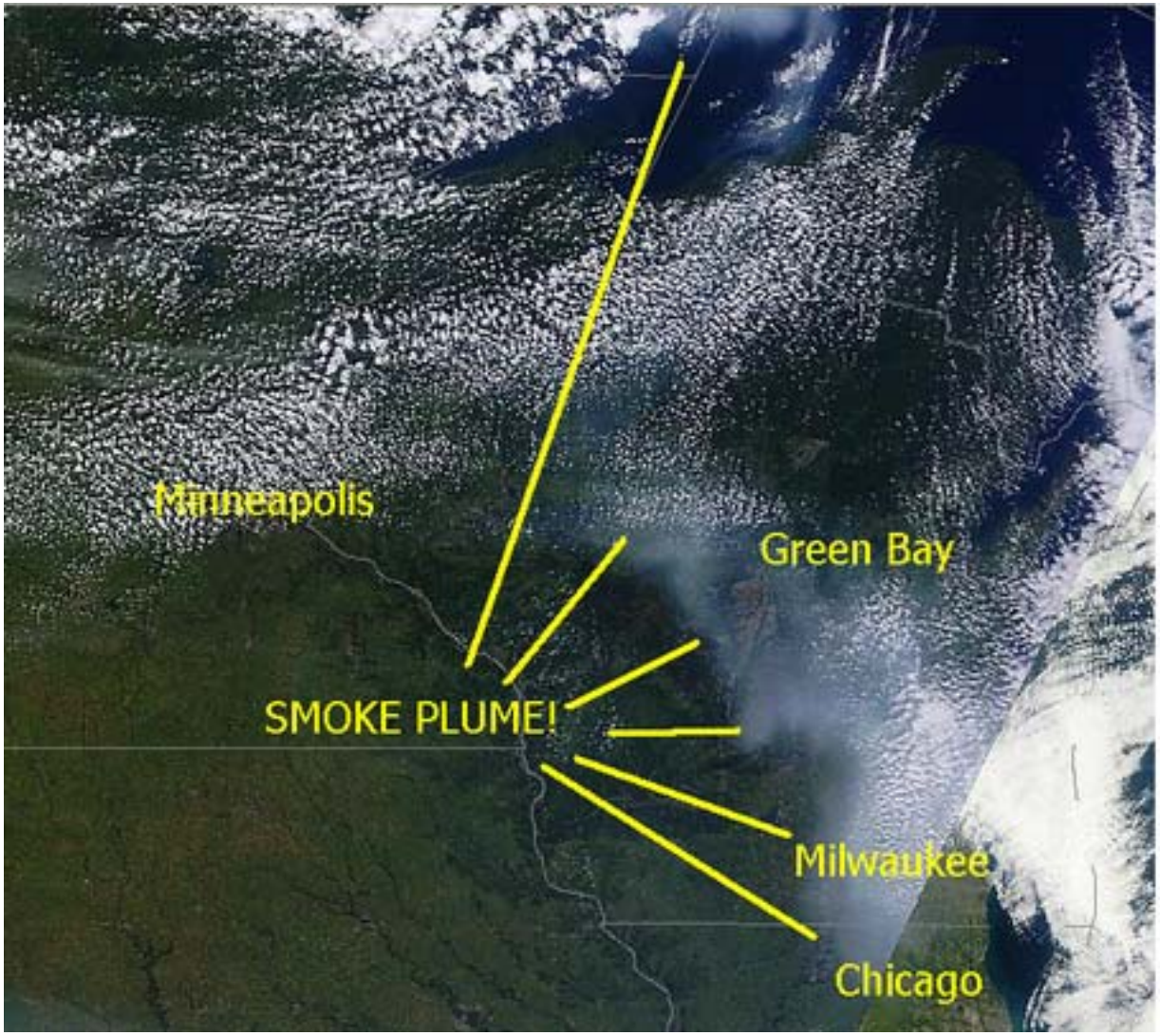
http://www.srh.noaa.gov/lzk/?n=summer2011yr.htm

U.S. Global Change Research Program

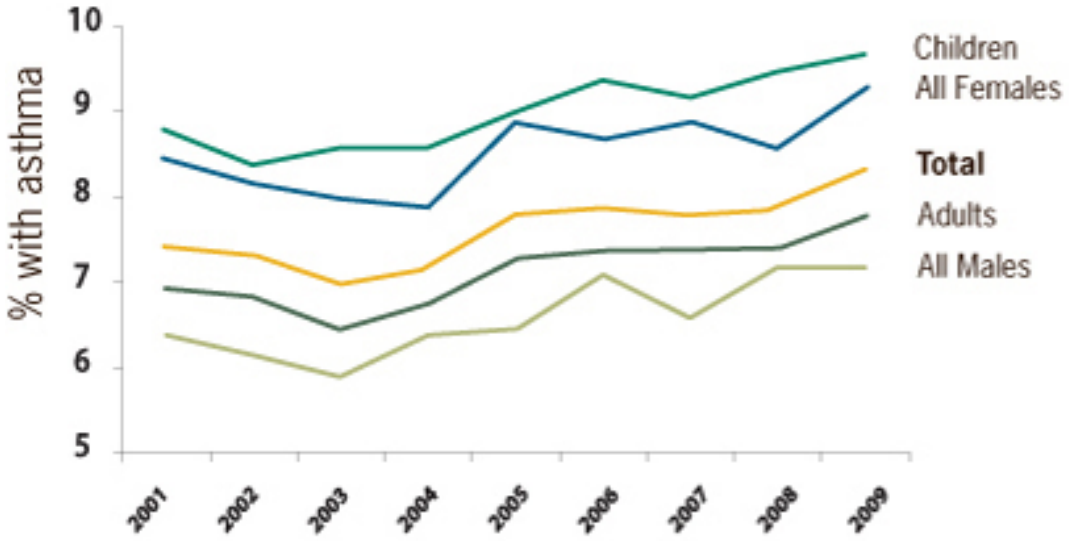
Percent of annual rainfall that comes down in top 1% of rain events



NASA MODIS Terra image taken Tuesday clearly shows smoke plume from Pagami Creek Fire reaching Milwaukee and Chicago.



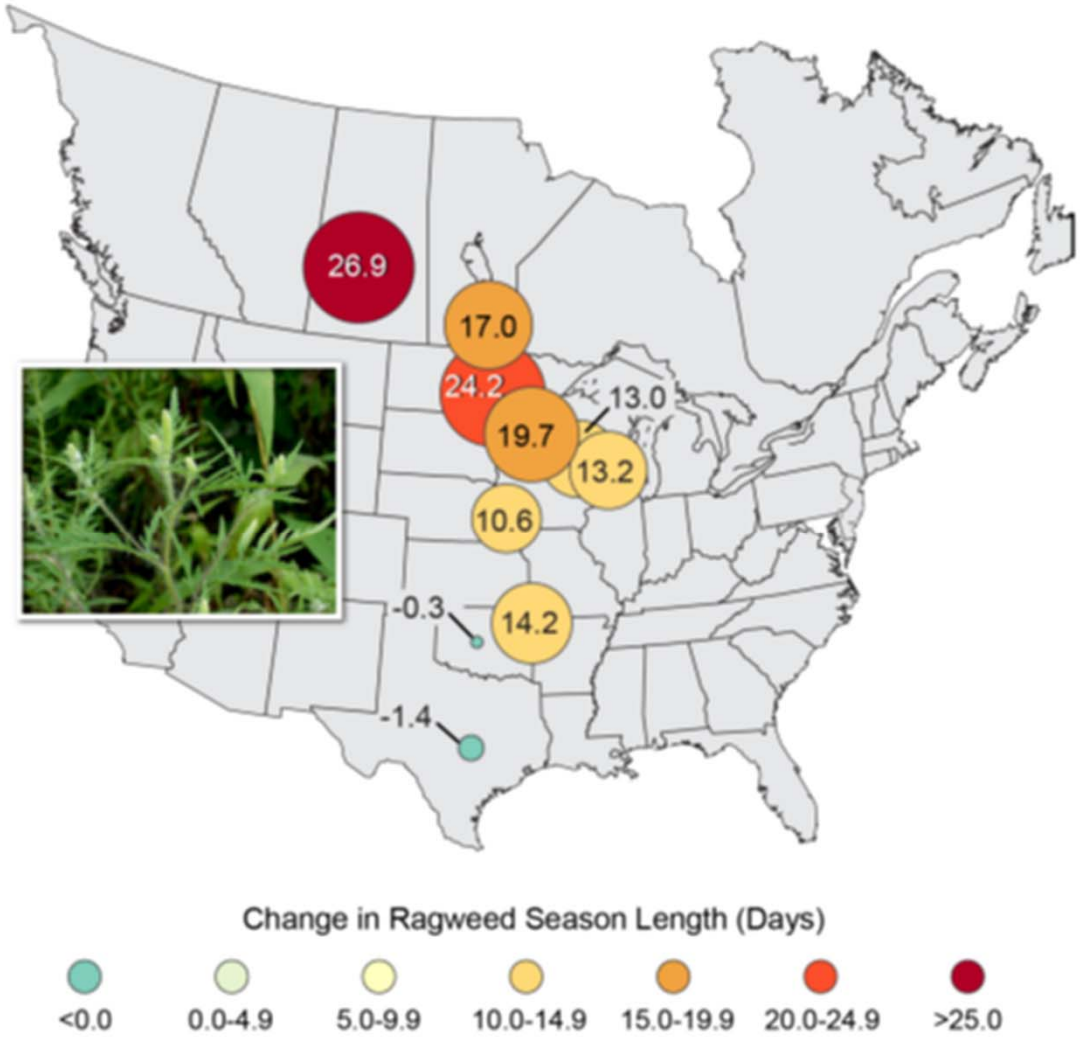
CDC on Asthma Rising



The number of people with asthma continues to grow. One in 12 people (about 25 million, or 8% of the population) had asthma in 2009, compared with 1 in 14 (about 20 million, or 7%) in 2001.

The greatest rise in asthma rates was among black children (almost a 50% increase) from 2001 through 2009

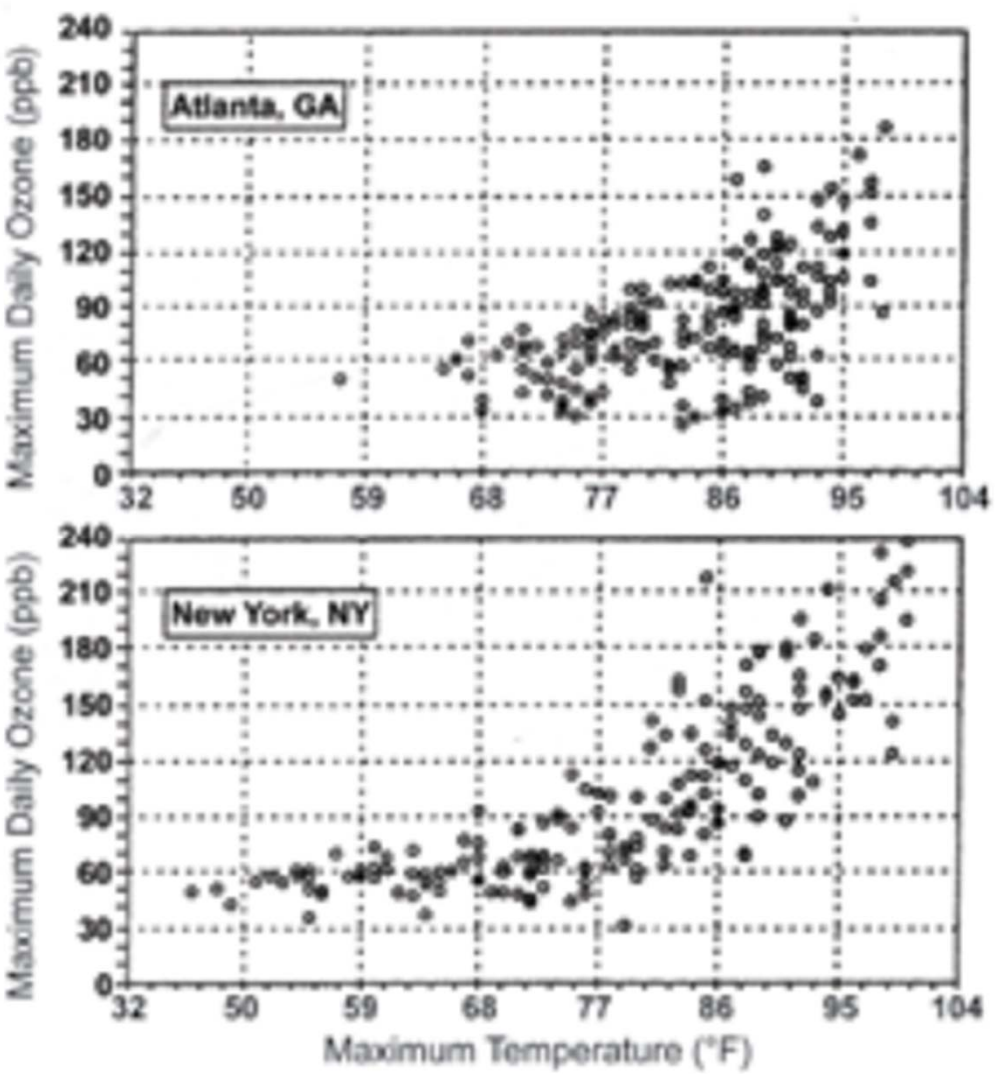
RAGWEED



Change in ragweed season length throughout the interior of North America from 1995 to 2011. This is in response to rising temperatures in the area.

U.S. Global Change Research Program. (2014) Global Climate Change Impacts in the United States. Third U.S. National Climate Assessment., pg 223.

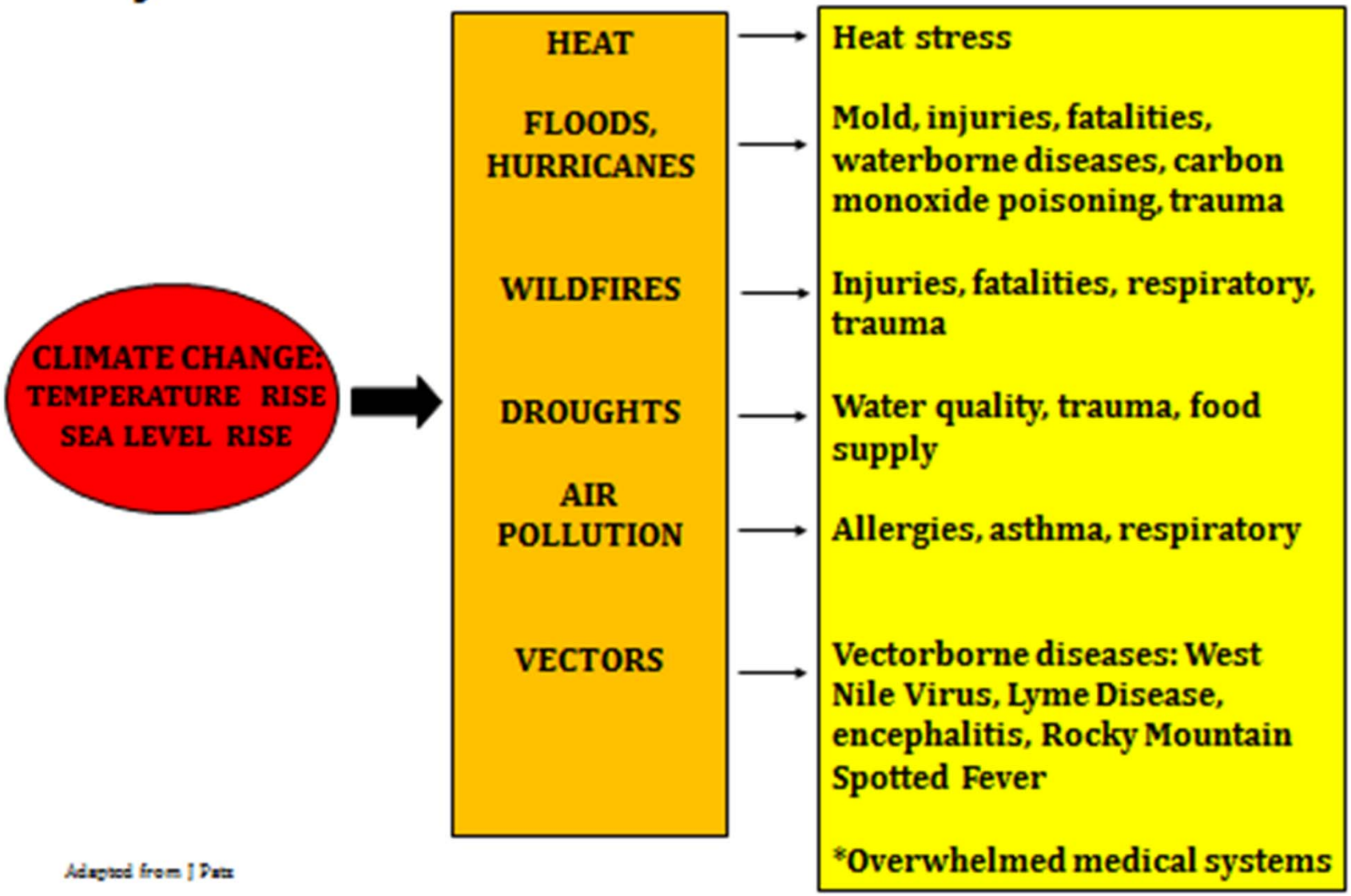
OZONE SMOG



These graphs from the USGCRP Assessment 2 plot temperature and ozone against each other and show clearly that rising ozone accompanies rising temperatures in cities as far apart as Atlanta, GA and New York, NY.

U.S. Global Change Research Program. (2009) Global Climate Change Impacts in the United States. Second U.S. National Climate Assessment.

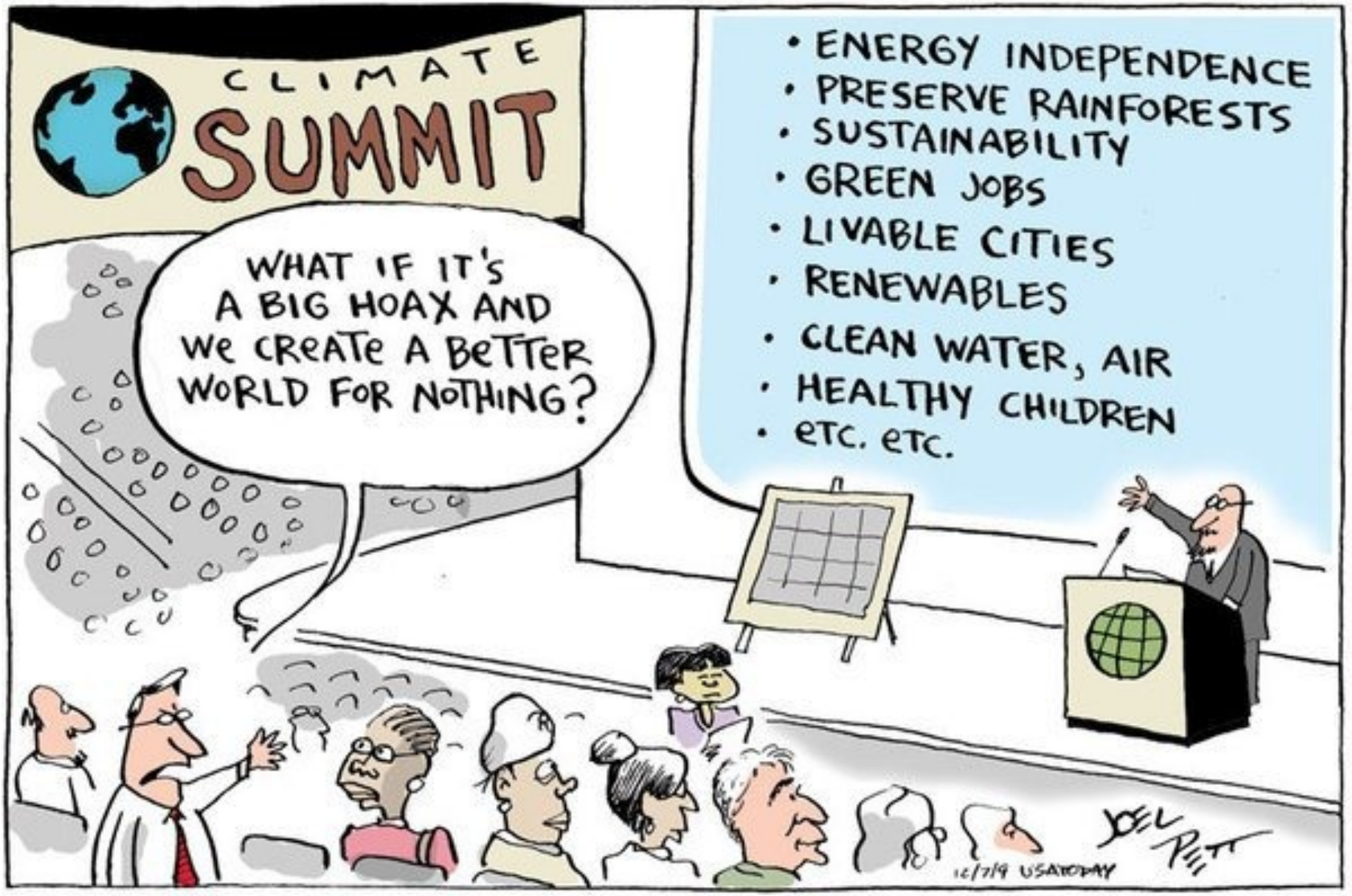
Why does this matter? Health effects in US



Adapted from J Patz

Clean Renewable Energy? Efficiency? It's Just Good For Public Health

Co-Benefits


CLIMATE
SUMMIT
WHAT IF IT'S A BIG HOAX AND WE CREATE A BETTER WORLD FOR NOTHING?
• ENERGY INDEPENDENCE
• PRESERVE RAINFORESTS
• SUSTAINABILITY
• GREEN JOBS
• LIVABLE CITIES
• RENEWABLES
• CLEAN WATER, AIR
• HEALTHY CHILDREN
• ETC. ETC.
12/7/19 USATODAY
JOEL PETT