

Climate Change and Health

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September 2013



climate**health**connect

The Center for Public Health & Climate Change

“Creating a Climate for Health”



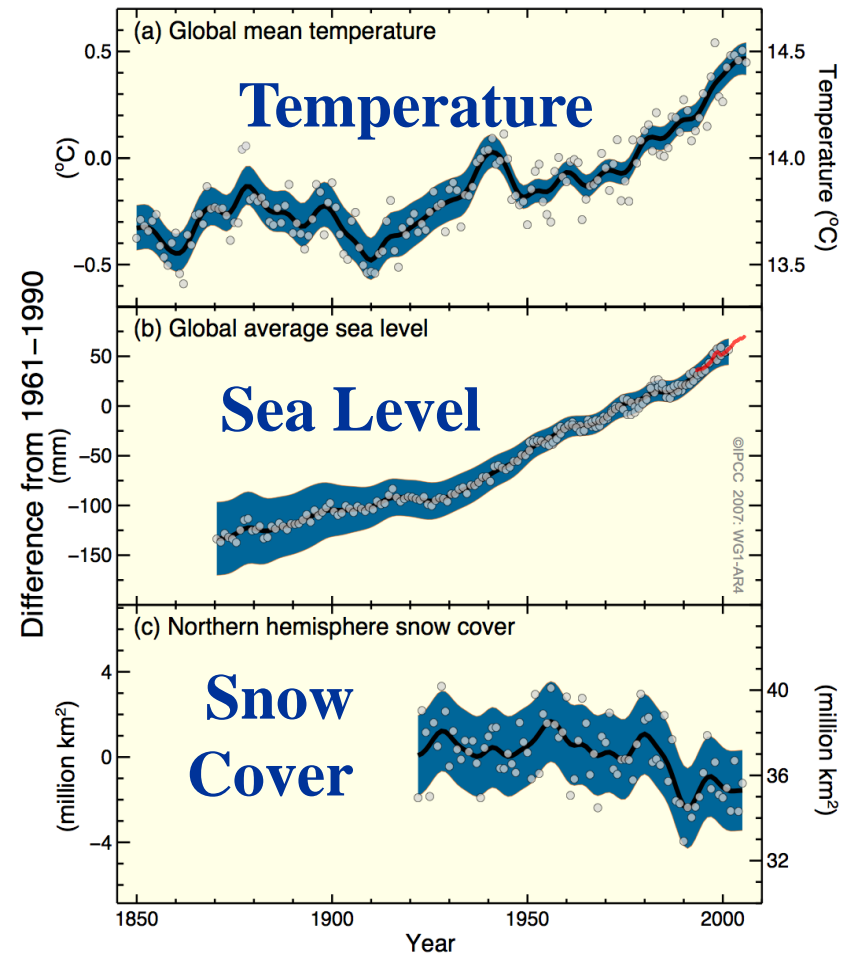
Climate Change and Health – Key Points

- Climate change is the greatest public health challenge of the 21st Century.
- We can create a climate for health: Reducing, Ready, Resilient
- There are many win-win opportunities to simultaneously improve health and address climate change.
- We need faster and more aggressive action to avert catastrophic impacts on our children and grandchildren.

Climate Change is Happening Now

- Warming is unequivocal; most of the warming of the past 50 years is very likely (90%) due to increases in greenhouse gases.
- Warming *plus*: heat waves, wind patterns, drought, & more
- Physical and biological systems on all continents and in most oceans already affected by recent climate changes.
- Greenhouse gases at unprecedented levels, forcing the climate to change.
- Already committed to more warming (next few decades); choices about emissions affect the longer term more and more.
(IPCC2007)

Changes in Temperature , Sea Level and Northern Hemisphere Snow Cover





“Climate change is the biggest global health threat of the 21st century... The impacts will be felt all around the world – and not just in some distant future but in our lifetimes and those of our children.”

The Lancet



Health Impacts of Climate Change

More extreme temperatures	Heat	Heat stress, cardiovascular failure
Sea level rise Saline intrusion	Extreme weather	Injuries, fatalities
Stronger hurricanes & storm surges	Air pollution	Asthma, respiratory disease, heart disease
Increased ozone concentrations & diminished air quality	Allergens	Respiratory disease, poison ivy/oak
Increased pollen & natural air pollutants	Vector-borne disease	Malaria, dengue, encephalitis,
Increased precipitation and flooding	Water-borne disease	Cholera, camphylobacter cryptosporidiosis.....
Increased droughts and water scarcity, water contamination	Food-borne disease	Salmonella, shigella
Ocean acidification	Water & food supply	Malnutrition, food insecurity, diarrhea
More frequent wildfires	Environmental refugees	Forced migration, civil conflict, immigration
Range of disease vectors	Mental health	Anxiety, despair, depression, PTSD
Harmful algal blooms		

Adapted from J. Patz

Threats to Survival

- Climate change threatens the systems on which humans depend for survival
 - Air
 - Water
 - Food
 - Shelter
 - Peace/Security/Social Stability

Vulnerability and Resilience

■ Vulnerability

- Susceptibility to harm
- Exposure to, sensitivity to, ability to cope with or adapt
- Character, magnitude, and rate of climate change to climate change

■ Resilience

- the capacity to survive, recover from, and even thrive in changing climatic conditions.

Climate Change and the Health Gap



The Climate Gap



The Climate Gap



Extreme weather events

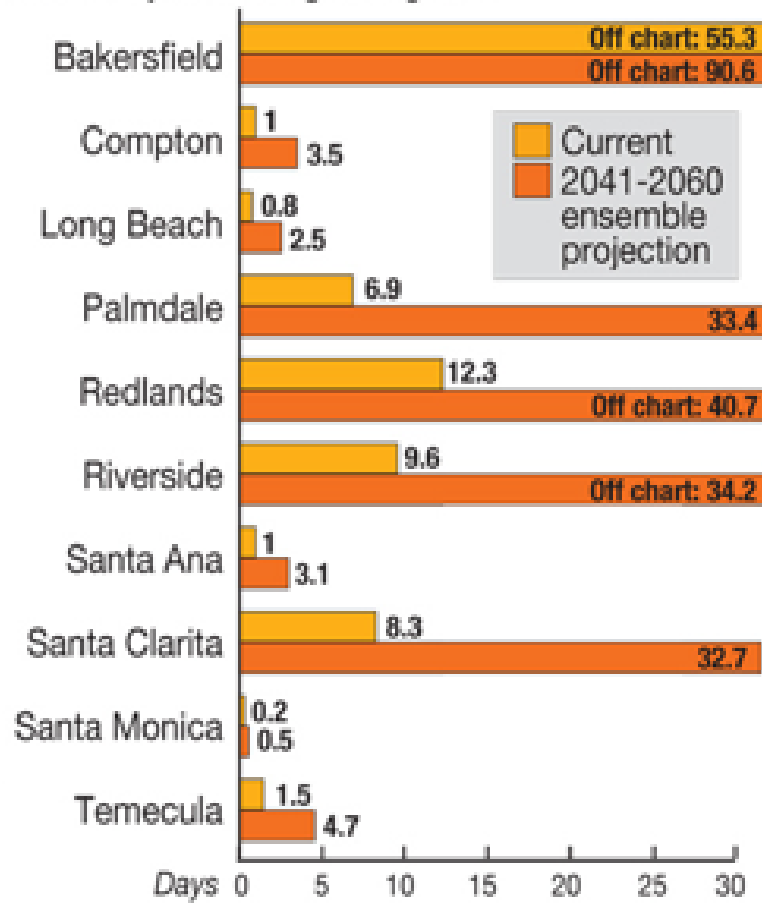
- Increased frequency & intensity
 - Hurricanes, extreme precipitation events, floods
- Impacts
 - Physical injury and death
 - Hyperthermia & dehydration
 - Hypothermia
 - Infectious diseases, water-borne diseases
 - Displacement
 - Mental health impacts



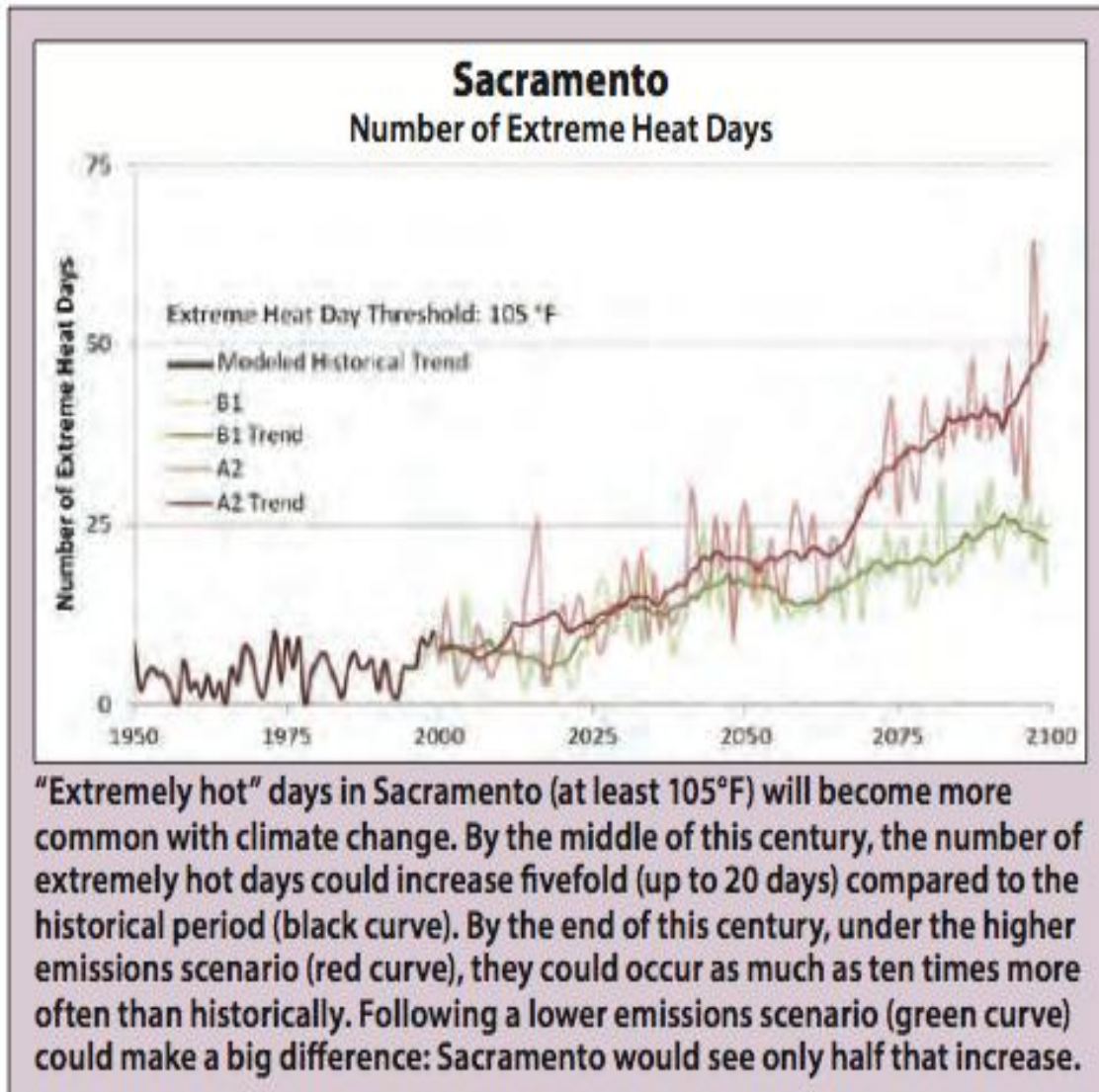
Extreme Heat Days Increase

Current and projected temperature extremes for Southern California

Annual days exceeding 95 degrees F



Hall, 2013, UCLA LARC



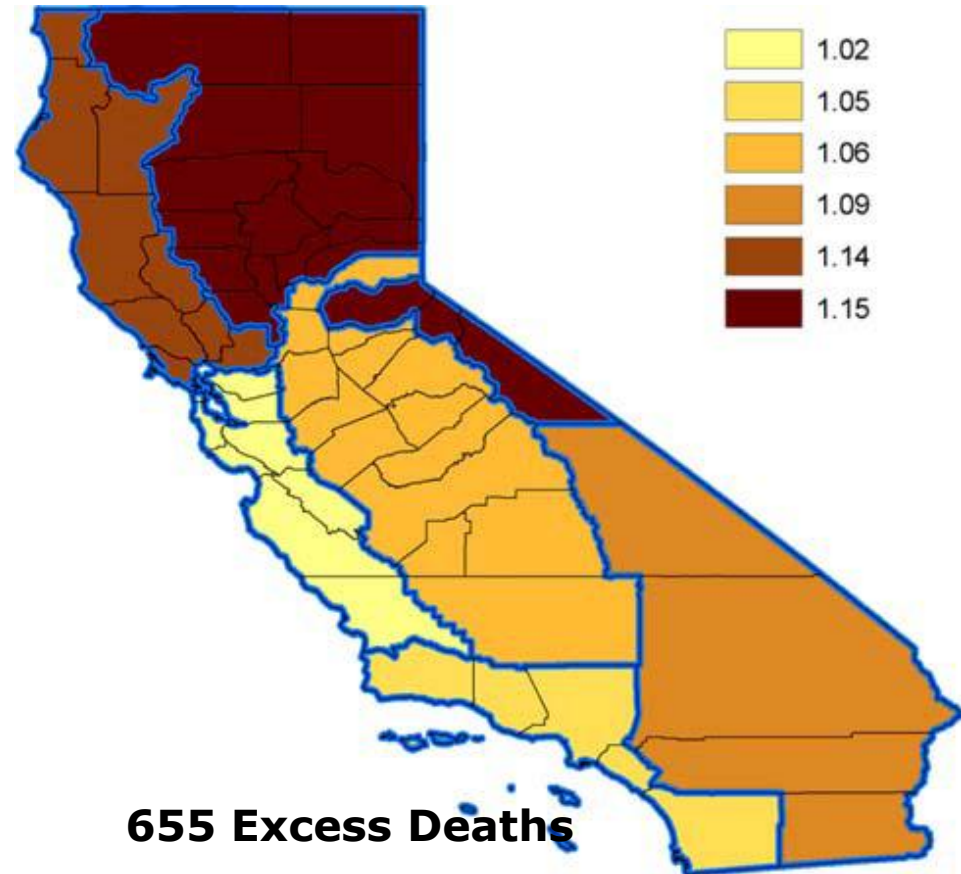
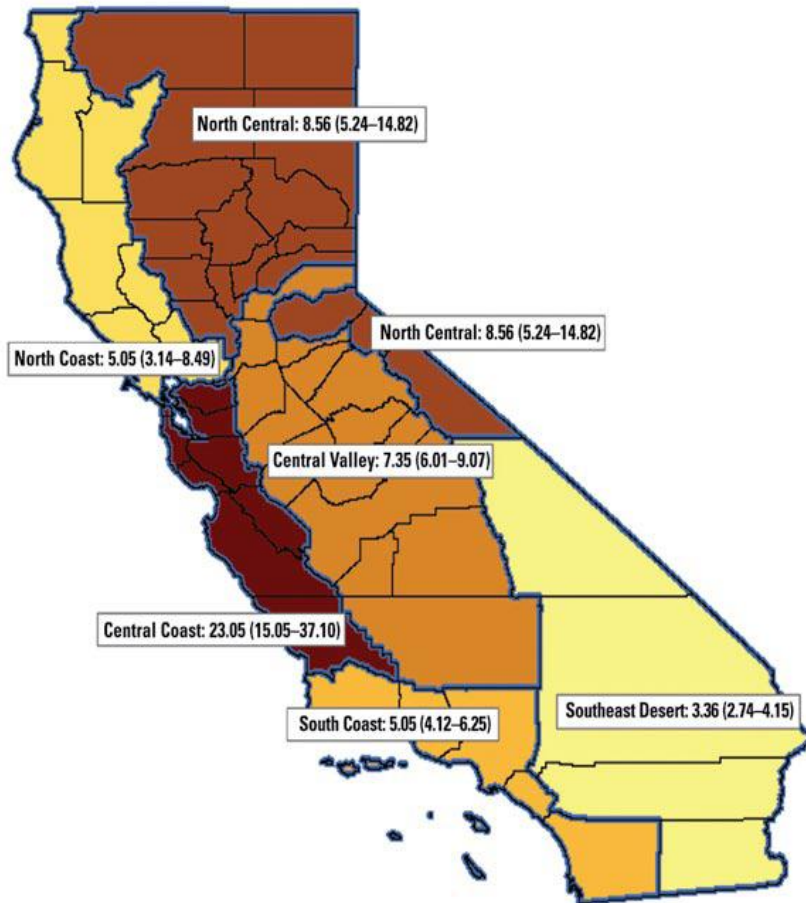
Heat Waves

Europe 2003

70,000 – 80,000 excess deaths



CA Heat Wave 2006: ER visit and mortality risk



Knowlton et.al. EHP, 2008
<http://ehp.niehs.nih.gov/mbbers/2008/11594/11594.pdf>

Hoshiko et.al.
<http://www.springerlink.com/content/583w83502xuj0416/fulltext.pdf>

Sketch of an Urban Heat-Island Profile

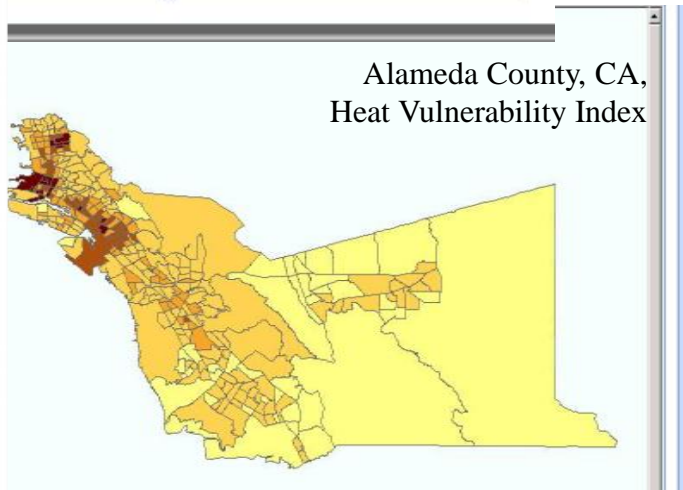
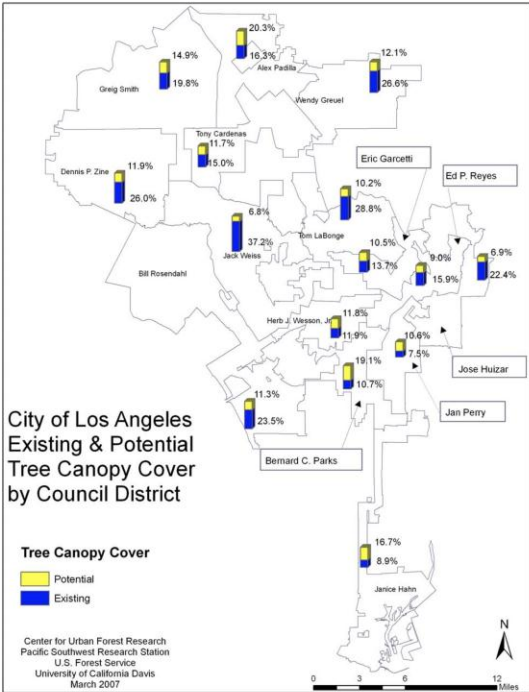
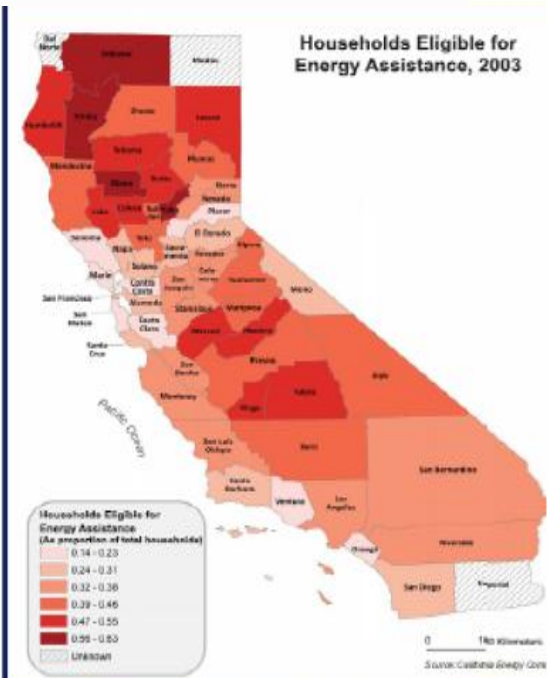
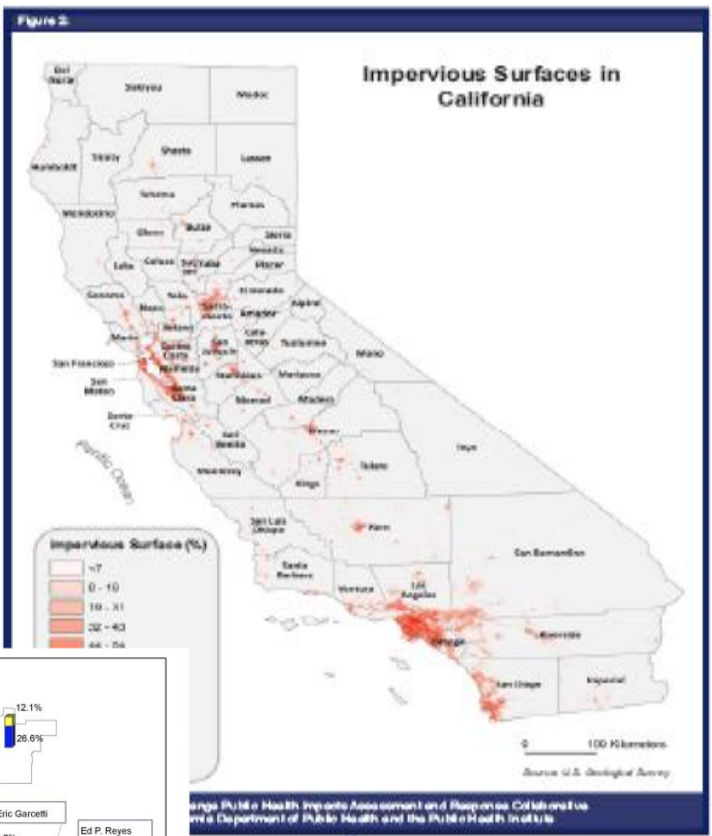
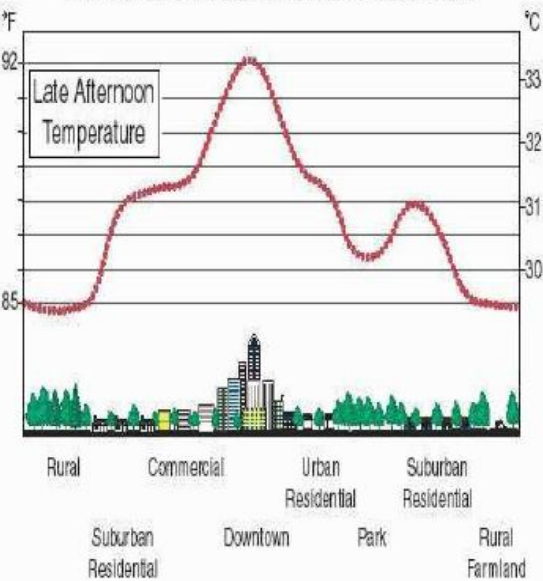
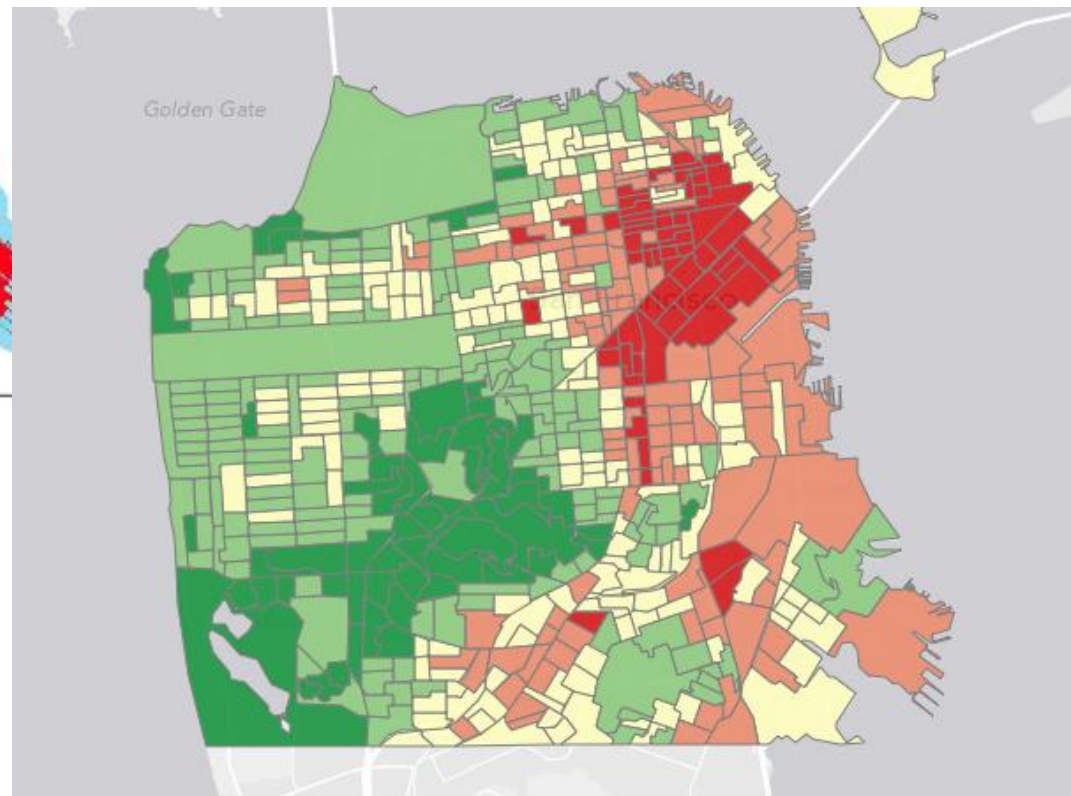
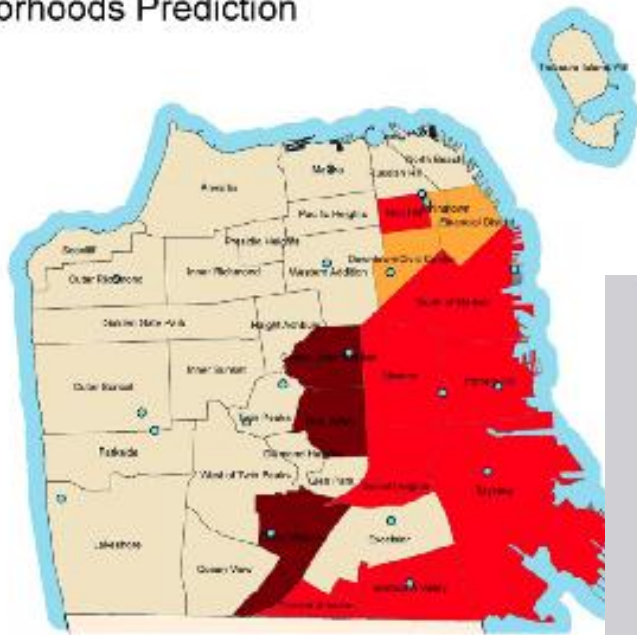


Figure 5. Existing and potential tree canopy cover by council district

Heat Vulnerability in San Francisco

Warm Neighborhoods Prediction

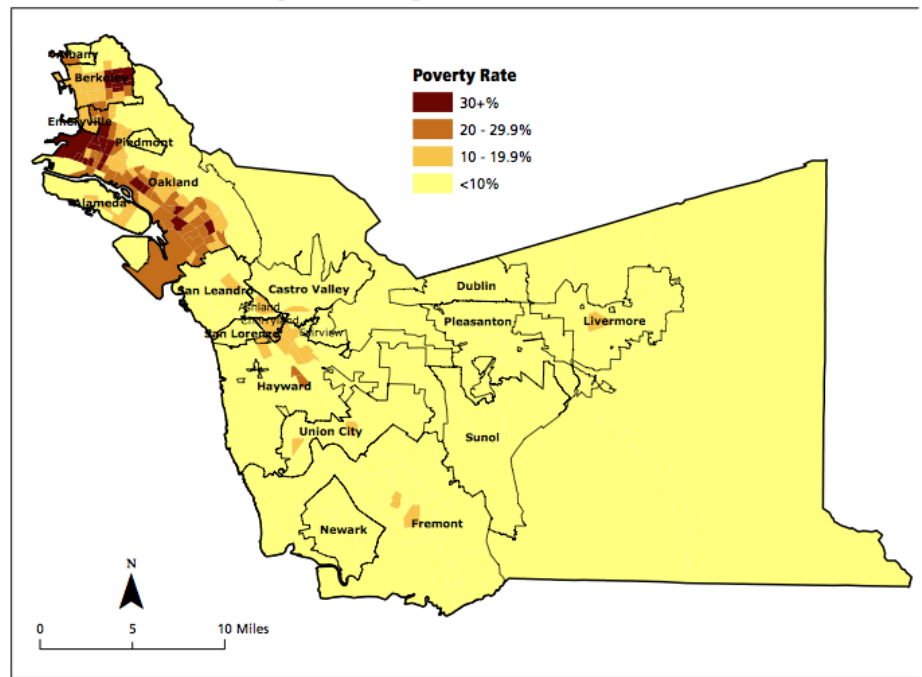
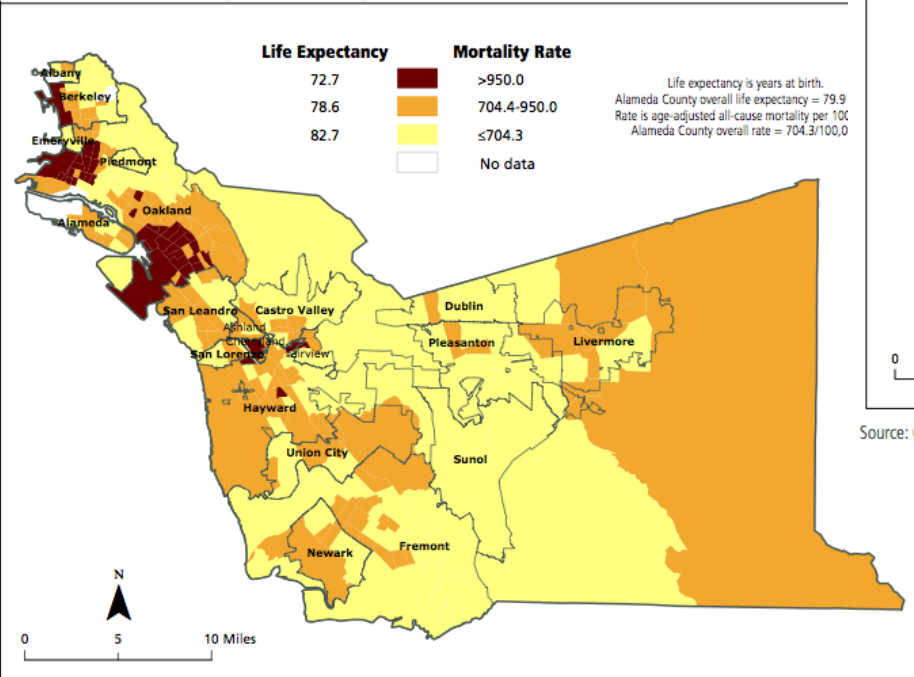
- Weather Stations
- Warm Neighborhoods Description
 - Air Temp Warm
 - Both Warm
 - Surface Temp Warm
 - Not Warm



<http://www.sfpbes.org/component/jdownloads/finish/42/269>

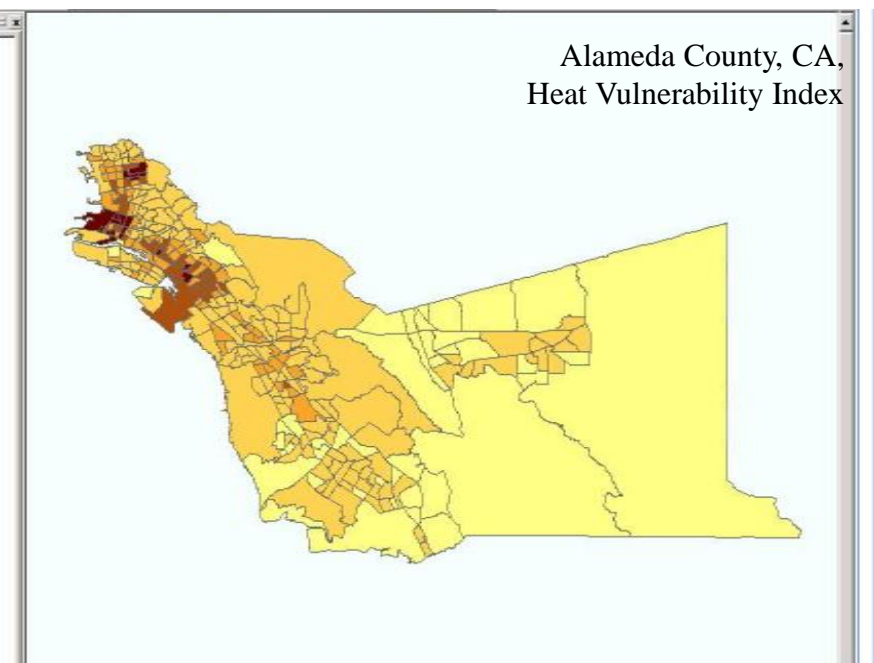
<http://www.sfpbes.org/news/219-climate-health-open-data>

Health Outcomes - Alameda County



Source: Census 2000.

Source: Alameda County vital statistics files, 2001-2005.

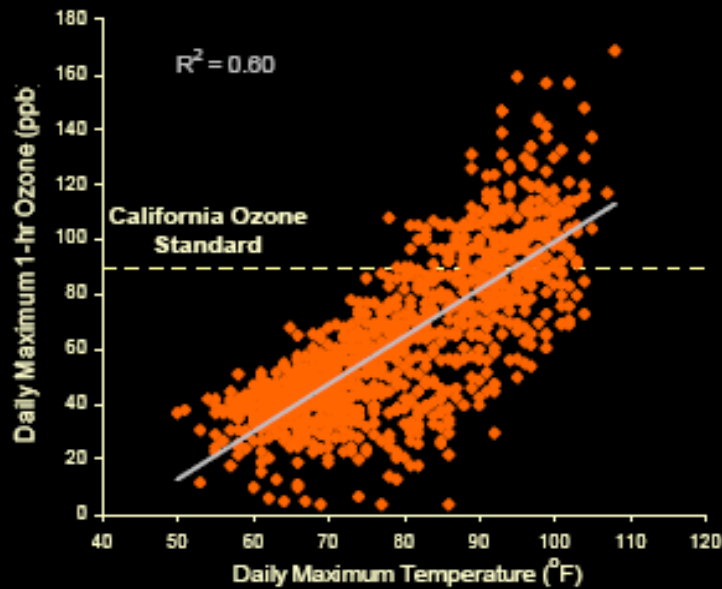


Heat Adaptation & Resilience

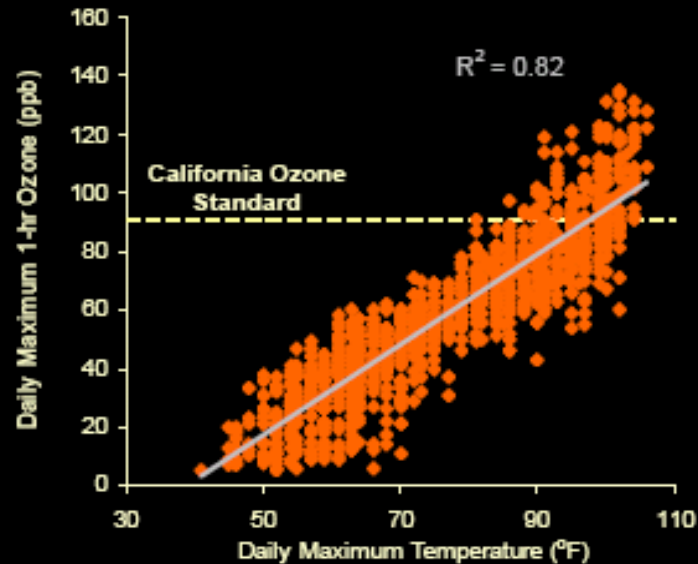
- Promote community resilience to reduce vulnerability to climate change
 - Reduce health inequities
 - Identify populations vulnerable to urban heat islands
 - Map heat vulnerability locally
 - » e.g. temperature, tree cover, surfaces, ozone, fuel poverty
 - Implement policies to protect vulnerable populations
 - Cal OSHA Heat Standard
 - Household energy assistance
 - Urban heat island mitigation
 - Urban greening
 - SGC grants
 - Built environment
 - Cool pavement, cool roofs, energy efficiency
 - Building codes, incentives
 - Reduce baseline exposures
 - Air pollution
 - Expand clean technologies/fuels in ports, rail yards, transportation corridors
 - Address cumulative burdens in polices to address GHG emissions
 - Build stronger social support networks
 - Community-based strategies, resilience groups, transition towns
 - Participatory and inclusive climate action planning, integrate into health equity
 - Need more research on acclimatization (heat)

Higher Temperatures Worsen Air Pollution

Ozone versus Temperature



Riverside, 2003-2005



Fresno, 2003-2005

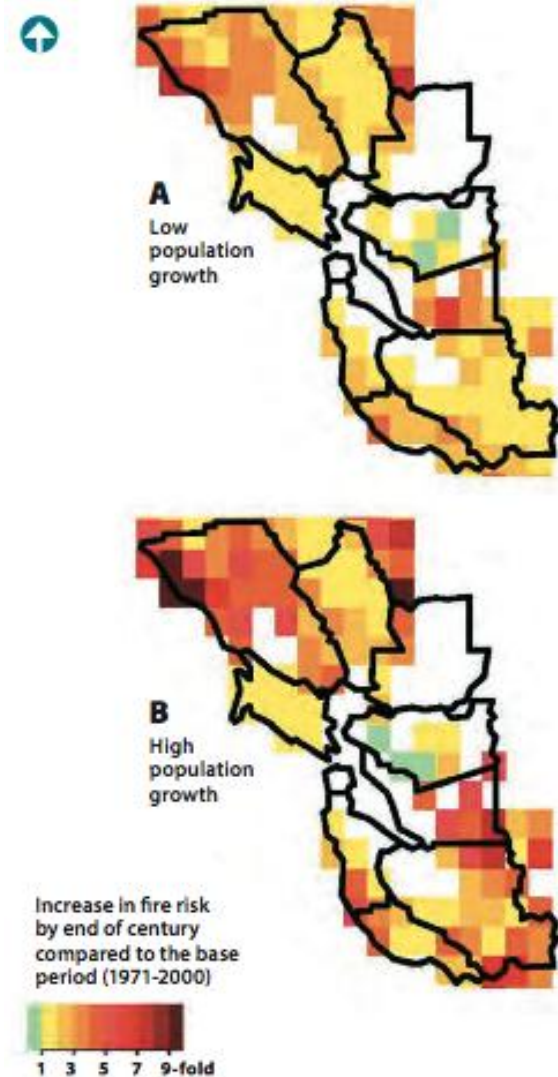
The Climate Penalty

- Warmer temps will increase frequency of days with unhealthy levels of ground-level ozone
- May push O₃ concentrations beyond current year-to-year variability; may lengthen the O₃ season.
- Possible increase in biogenic emissions of O₃ precursors, (eg VOCs); possible increases in lightning NO_x production may also be a factor in future O₃ changes
- Bay Area: the sensitivity of ozone to increases in temperature is relatively large compared to other regions in the state, suggesting the Bay area may be particularly sensitive to climate change (Steiner, Tonse et al. 2006).

Wildfire Risk

- Earlier snowmelt, higher temperatures, longer dry periods, longer fire season
- Changes in vegetation
- Ignition potential from lightning
- Human activities biggest factor in ignition risk
- Increases in the number of large fires statewide ranging from 58 percent to 128 percent by 2085
- Estimated burned area will increase by 57 percent to 169 percent

Wildfire Risk in San Francisco Bay under Different Population Growth Scenarios



Rim Fire August, 2013

- NDEP expects very unhealthy air quality conditions to remain in Carson City and Douglas County throughout the weekend
 - Air quality is so bad that even the healthiest of individuals could be in danger if they spend too much time outdoors
 - Shelter in place, stay indoors
 - Use air conditioning if possible, to help filter air throughout a house
 - Keep all doors and windows shut in both home and vehicles
 - Humidifiers will help the air quality in a home or building
 - Masks are available for purchase at hardware stores and can really help filter the air and aid in comfort.



Spare the Air Days

- “District officials are encouraging Bay Area residents to walk, bike, carpool or use public transit instead of driving on Friday.”
- “Unhealthy for Sensitive Groups: Active children and adults, and people with respiratory disease, such as asthma, should limit outdoor exertion.”

Pollen and allergies

- Increases in CO₂ and temperature can result in increases in pollen production and atmospheric pollen concentrations.
 - Likely increase in average US pollen counts from 8,455 grains/m³ (2000) to 21,735 grains/m³ (2040).
 - Possible doubling of ragweed pollen production by 2100

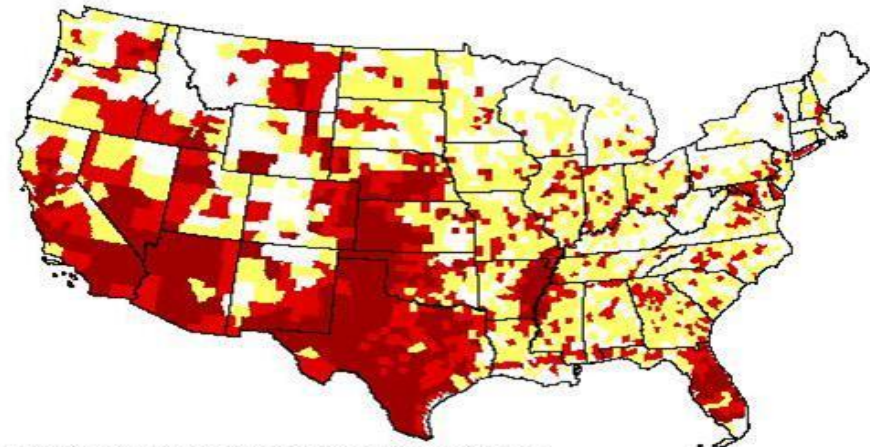
Drought



- Stephen Chu (Secretary, Dept of Energy)

“... you're looking at a scenario where there's no more agriculture in California. When you lose 70 percent of your water in the mountains, I don't see how agriculture can continue. California produces 20 percent of the agriculture in the United States. I don't actually see how they can keep their cities going.”

Water Supply Sustainability Index (2050) With Climate Change Impact

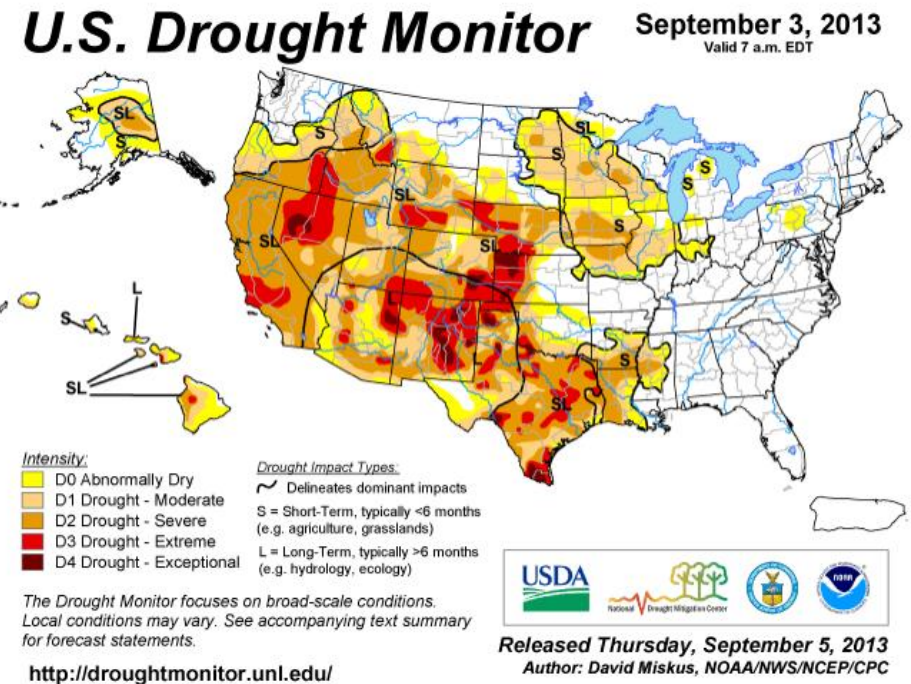


Number of Counties for each Category in Parentheses



Drought & Dust

- **Coccidioidomycosis (Valley Fever)**
- California cases
 - 1998: 719 (2.1/100,000)
 - 2011: 5,697 (14.9 per 100,000)
 - average annual increase of 13%, $p < 0.001$
- “Factors such as drought, rainfall, and temperature might have resulted in increased spore dispersal”
 - disruption of soil by human activity
 - reporting changes



Health-Care Costs of Climate Events

Climate-related health stressor	Premature Deaths	Hospitalizations	Total Health-care Costs \$\$ (thousands)
Ozone pollution	795	4,150	6,534,642
Heat wave	655	1,620	5,353,425
Hurricane	144	2,197	1,392,833
Infectious disease	24	204	207,447
River flooding	2	43	20,357
Wildfires	69	778	578,640
Total	1,699	8,992	\$14,087,344

Knowlton, Health Affairs, 2011

Creating a Climate for Health

- Reduce GHG emissions
- Get **Ready** for climate change
- Support climate **Resilient** communities

Adaptation and Mitigation

- Mitigation involves attempts to slow, stabilize, or reverse the process of global climate change by lowering the level of greenhouse gases in the atmosphere
 - Public health primary and secondary prevention
- Adaptation involves developing ways to protect people and places by reducing their vulnerability to and lessen the impact of climate change
 - Public health preparedness & response, tertiary prevention

What are Co-Benefits?

- Multiple strategies for climate change mitigation
- Primary benefits
 - reductions in the expected long-term consequences of global warming; avoided damages of climate change
- Co-benefits (or ancillary benefits)
 - Indirect benefits of GHG emission reduction
 - The economic, social, environmental, public health and other benefits of global warming policies that are independent of any direct benefits from reducing or mitigating global warming.

AB32 and Air Pollution

- The net effect of all AB 32 measures reduced statewide primary PM and NOx emissions by ~1 % and ~15 %, respectively.
- These emissions reductions lower population-weighted PM2.5 concentrations by ~6 % for California (esp in South Coast Air Basin)

Transportation Health and Climate Co-Benefits

■ Reductions

- GHG emissions
- Air pollution
- Noise
- Infrastructure costs
- Community severance

■ Increases

- Physical activity
- Social capital

■ Reductions

- Respiratory disease
- Cardiovascular disease
- Diabetes
- Depression
- Osteoporosis
- Cancer Stress

■ Avoidable increases

- Bike/ped injuries



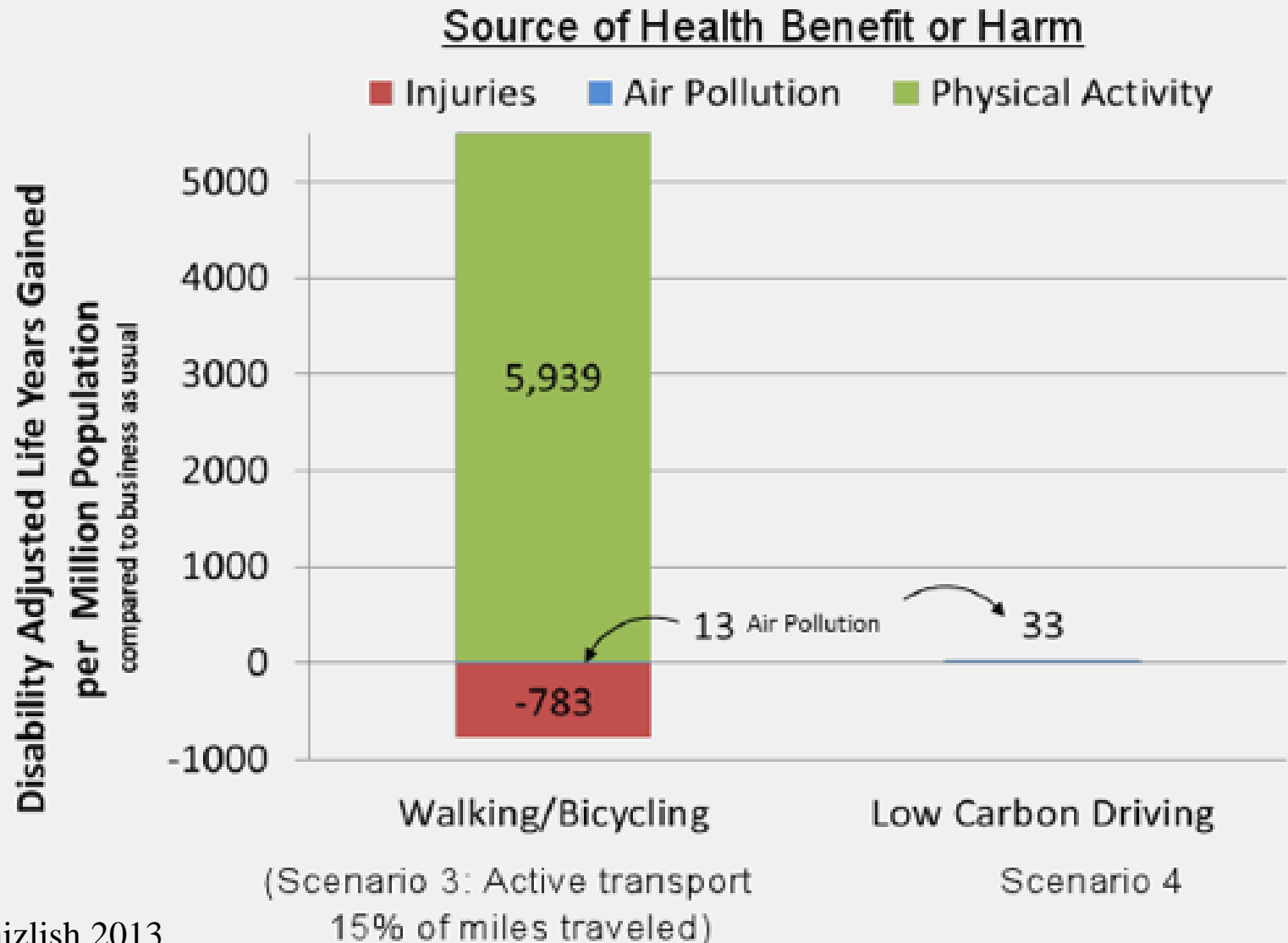
Active Transportation and Health

Shift in active transport from <5 to 22 minutes/day (2% to 15% mode share) in Bay Area

- 14% reduction heart disease, stroke, diabetes
- 6-7% reduction depression, dementia
- 5% reduction breast and colon cancer
- Added 9.5 months life expectancy
- 19% increase bike/ped injuries
- \$1.4 to \$22 billion annual Bay Area health cost savings
- >14% reduction in GHG emissions



Annual Health Benefits of Active Transport and Low Carbon Driving in the Bay Area: Predictions from the ITHIM Model



Climate and Health Co-benefits of Sustainable, Local Food Systems

■ Reductions

- GHG emissions
- Pesticide use
- Synthetic fertilizer use
- Food miles (air pollution)
- Antibiotic use
- Water pollution
- Soil erosion
- Biodiversity loss
- Meat consumption
- Unsustainable H2O consumption

■ Increases

- Access affordable healthy food
- Rural community strength
- Agricultural land preservation

■ Reductions

- Obesity
- Cardiovascular disease
- Cancer (breast, prostate, colorectal)
- Type II Diabetes
- Antibiotic resistance
- Pesticide illness

Climate and Health Co-benefits of Urban Greening

■ Increases

- Places to be active
 - Physical activity
- Urban food growing
 - Access healthy foods
- Neighborhood aesthetics
 - Reduce crime
- Social networks
 - Social support
 - Disaster resilience

■ Reductions

- Heat island effect
- Energy consumption
 - Lower fuel costs
- Air pollution
- Storm water run-off
 - Decrease flood risk
 - Decrease sewage risk

Climate Ready and Resilient for Heat and Health

■ Buildings:

- Up-date Green Building and Building Energy Efficiency Standards

■ Surfaces:

- Expand the use of porous pavements

■ Urban Greening:

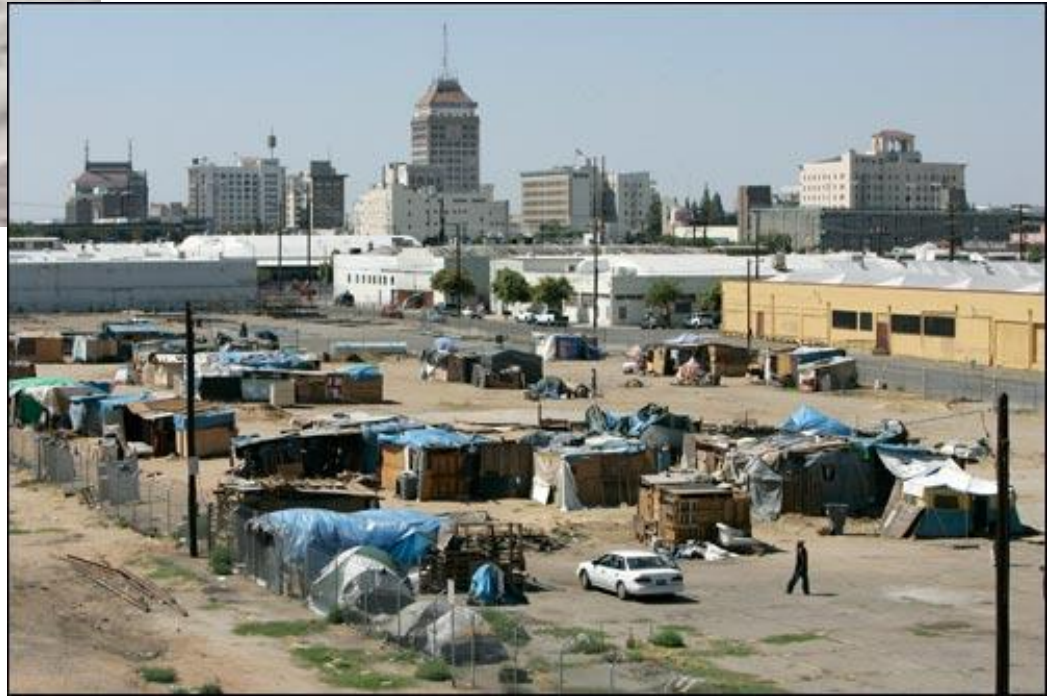
- Trees – green roofs – green open space – urban streams

■ Extreme Heat Events:

- Improve Heat-Health Warnings
- Identify vulnerable populations
- Protect the energy grid
- Protect outdoor workers









Action is Urgent: the Critical Decade

“...we have at most 10 years -- not 10 years to decide upon action, but 10 years to alter fundamentally the trajectory of global greenhouse emissions.”

“There is still time, but just barely.”

James Hansen

- “If we don’t take action regarding climate change, our future generation will be roasted, toasted, fried, and grilled.”

Christine Lagarde, Chief, IMF

- “If there is not action soon, the future will become bleak.... My wife and I have two sons...when they grow old, this could be the future they inherit.

Dr. Jim Young Kim, President World Bank

Once again.....

- Climate change happening now
 - Faster than expected
 - Upper end of IPCC scenarios
- Impacts health in many ways, directly & indirectly
- Will affect life systems on which we depend
 - Air, water, food, shelter
- Climate gap
 - Vulnerable communities most at risk
- If we act urgently and aggressively we can
 - Prevent the most catastrophic climate scenarios
 - Promote mitigation and adaptation strategies with health co-benefits
 - Build resilient communities to adapt better

Thank you!

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