Climate Change & Health

California Department of Public Health

Linda Rudolph, MD, MPH

January 29, 2010

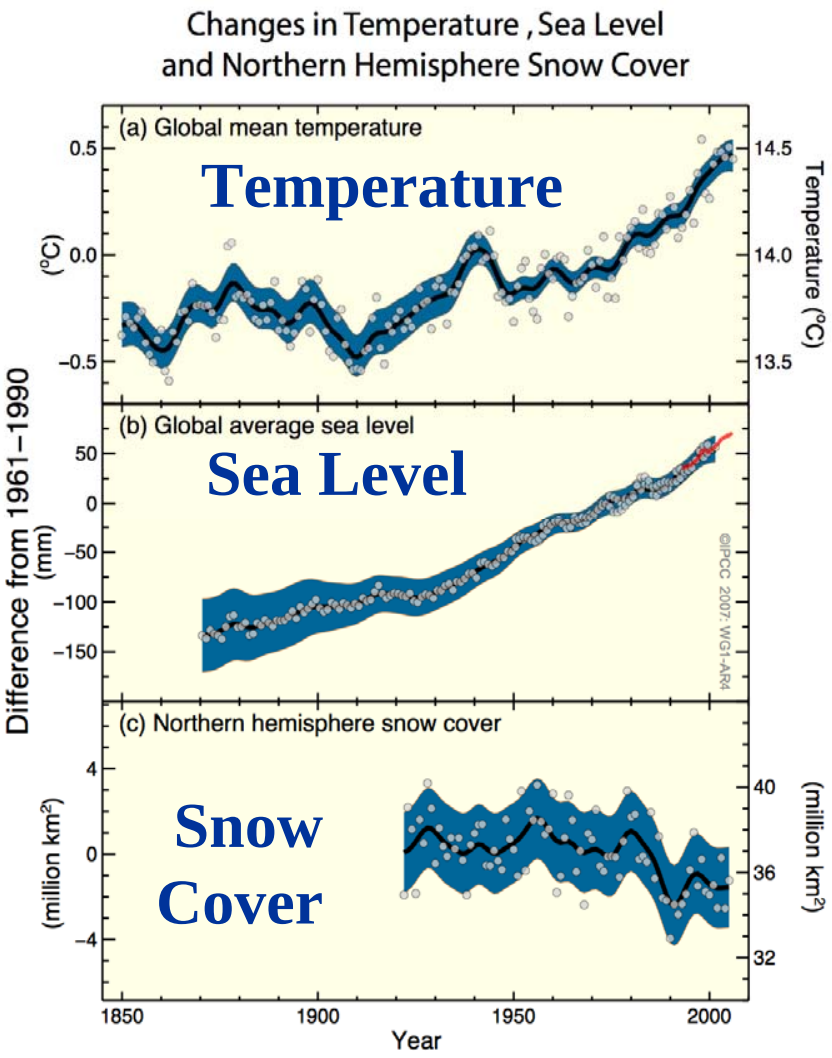
Why must public health be involved?

- 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

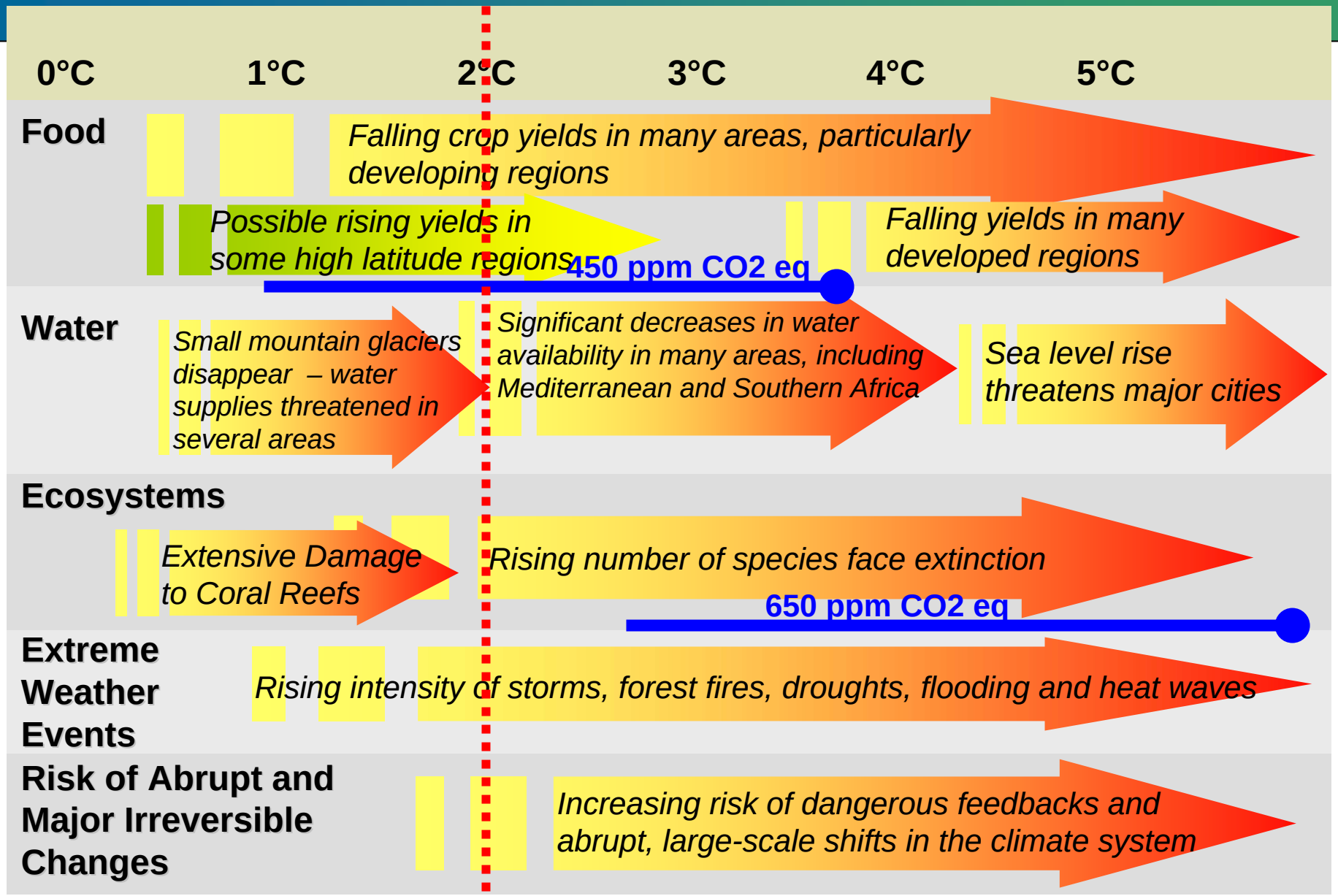
Climate Change is Happening Now

- 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.

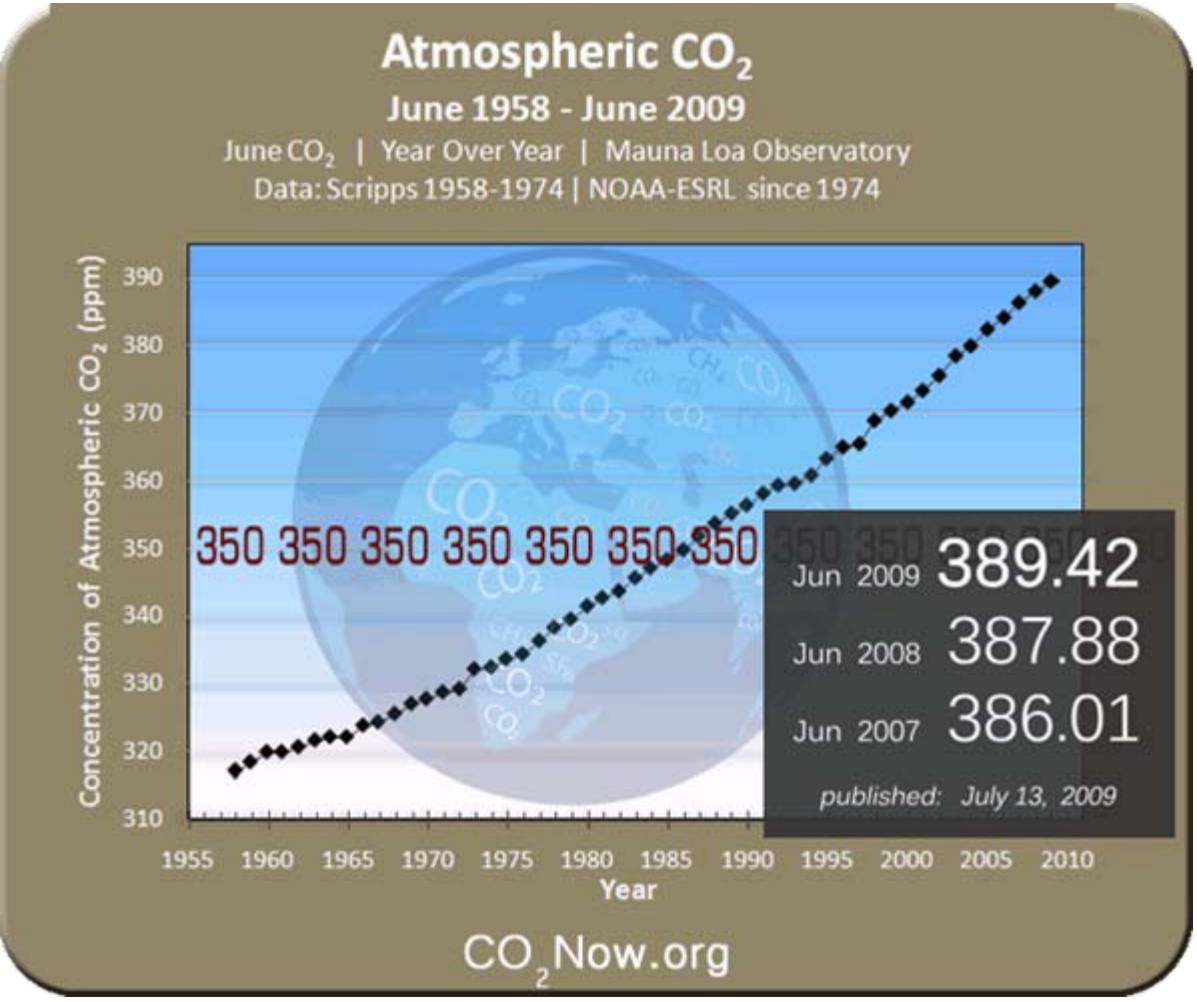
(IPCC2007)



Projected Impacts of Global Temperature Change



350 - The Most Important Number



If humanity wishes to preserve a planet similar to that on which civilization developed and to which life on Earth is adapted, paleoclimate evidence and ongoing climate change suggest that CO2 will need to be reduced from its current 385 ppm to at most 350 ppm."

James Hansen, 2008

WE are causing climate change

Most of the observed increase in global average temperatures since the mid-20th century is very likely due to the … increase in (human-caused) green-house gas concentrations (in our atmosphere).

—IPCC (2007)

Climate change is bad for people

"We need to… convince the world that humanity really is the most important species endangered by climate change."

—Margaret Chan, MD, Director-General, World Health Organization

"Climate change is one of the most serious public health threats facing our nation. Yet few Americans are aware of the very real consequences of climate change on the health of our communities, our families and our children."

—Georges Benjamin, MD, Executive Director American Public Health Association

Climate Change:

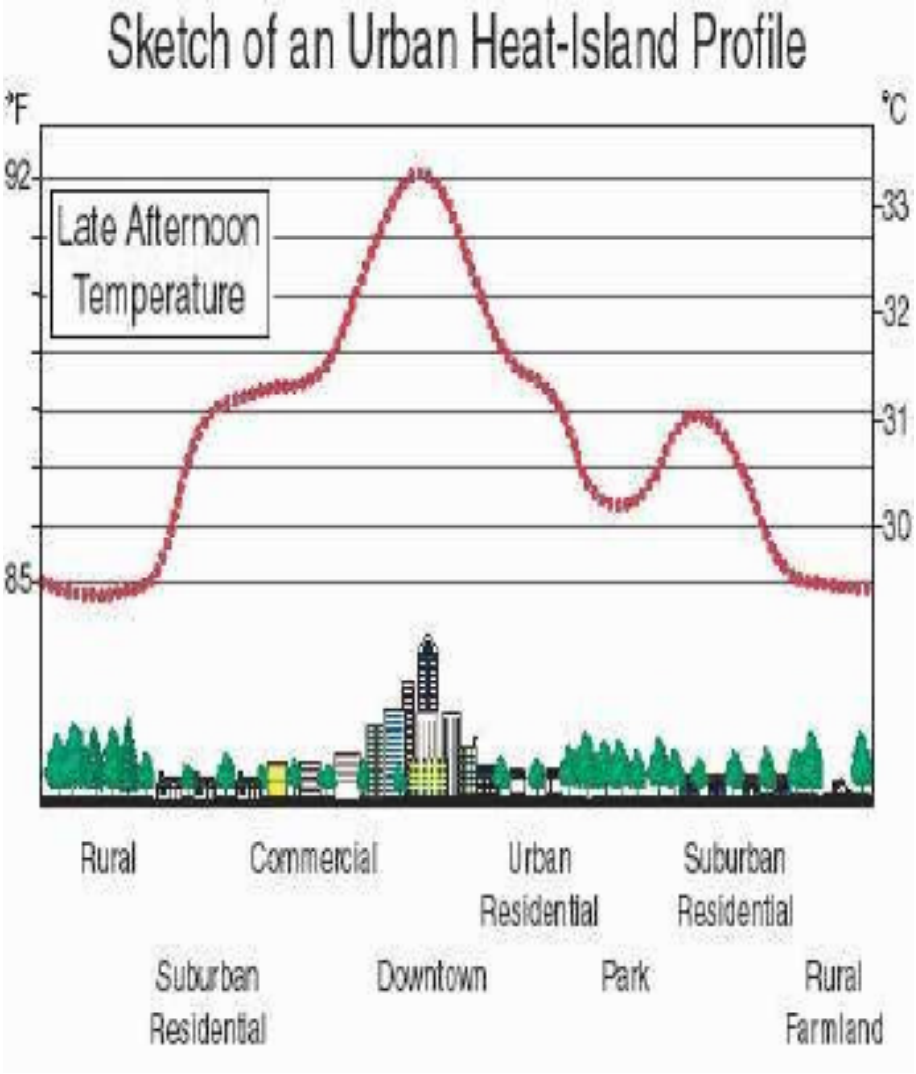
- Temperature rise
- Sea level rise
- Hydrologic extremes

HEAT	→ Heat stress, cardiovascular failure
SEVERE WEATHER	→ Injuries, fatalities
AIR POLLUTION	→ Asthma, cardiovascular disease
ALLERGIES	→ Respiratory allergies, poison ivy
VECTOR-BORNE DISEASES	→ Malaria, dengue, encephalitis, hantavirus, Rift Valley fever
WATER-BORNE DISEASES	→ Cholera, cryptosporidiosis, campylobacter, leptospirosis
WATER AND FOOD SUPPLY	→ Malnutrition, diarrhea, harmful algal blooms
MENTAL HEALTH	→ Anxiety, despair, depression, post-traumatic stress
ENVIRONMENTAL REFUGEES	→ Forced migration, civil conflict

Adapted from J. Patz

Heat

- Extreme heat events more frequent, more severe
- Heat stroke (plus heat rash, heat cramps), dehydration
- Exacerbation of respiratory and cardiovascular disease
- Vulnerable populations:
  - Children, elderly, work/play outdoors
  - Certain medications
- Urban Heat Island
  - Can add 7° – 12° F
- Europe 2003 estimated 35,000 - 70,000 deaths
- California 2006 estimated 350 – 650 deaths
- Los Angeles projected increase of 62% - 88% in heat-related mortality by 2080



Extreme Weather Events

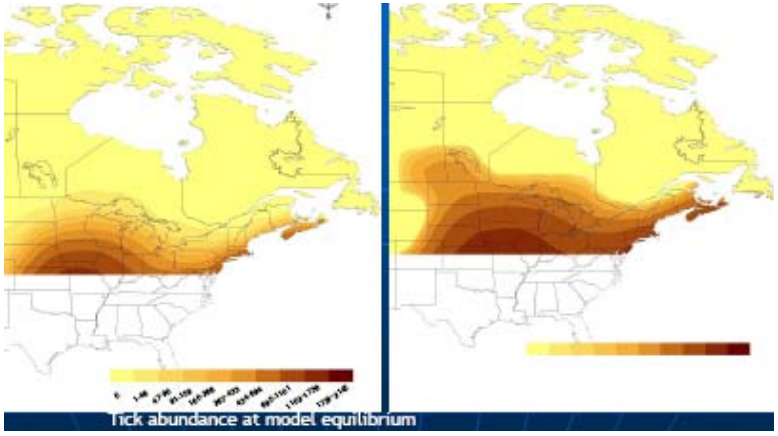
- Increased frequency and intensity:
  - Floods, hurricanes, electrical events, tornadoes, drought, forest fires
- Physical injury and death
- Hypothermia, dehydration
- Post-traumatic stress disorders
- Displacement
  - Loss of essential services – including medical care
  - Hunger and malnourishment
  - Civil disorder
- Infectious diseases, water-borne diseases
- Respiratory illness

Climate Change, Air Quality, and Health

- Air Pollution (ozone, particulates, acid precipitation, IAP)
  - Eye,nose,lung irritation
  - Decreased lung function
  - Aggravated asthma and bronchitis
  - Chronic respiratory illness/pulmonary inflammation
  - Reduced resistance to respiratory infection
  - Cardiovascular disease
- Allergens (molds, fungi, pollens)
  - Ragweed (*Ambrosia spp.)*
  - Increased CO2 and temperature cause increased pollen counts, longer growing season
- Dust
- High-risk: children, older people, outdoor workers, anyone with pre-existing CV or respiratory disease)

Vector-borne diseases

- Vector distributions will increase in latitude and altitude
  - 10-fold increase in density of malaria-bearing mosquitos in upper highlands of Africa
  - Northward migration of Lyme disease predicted



Food, water, and shelter

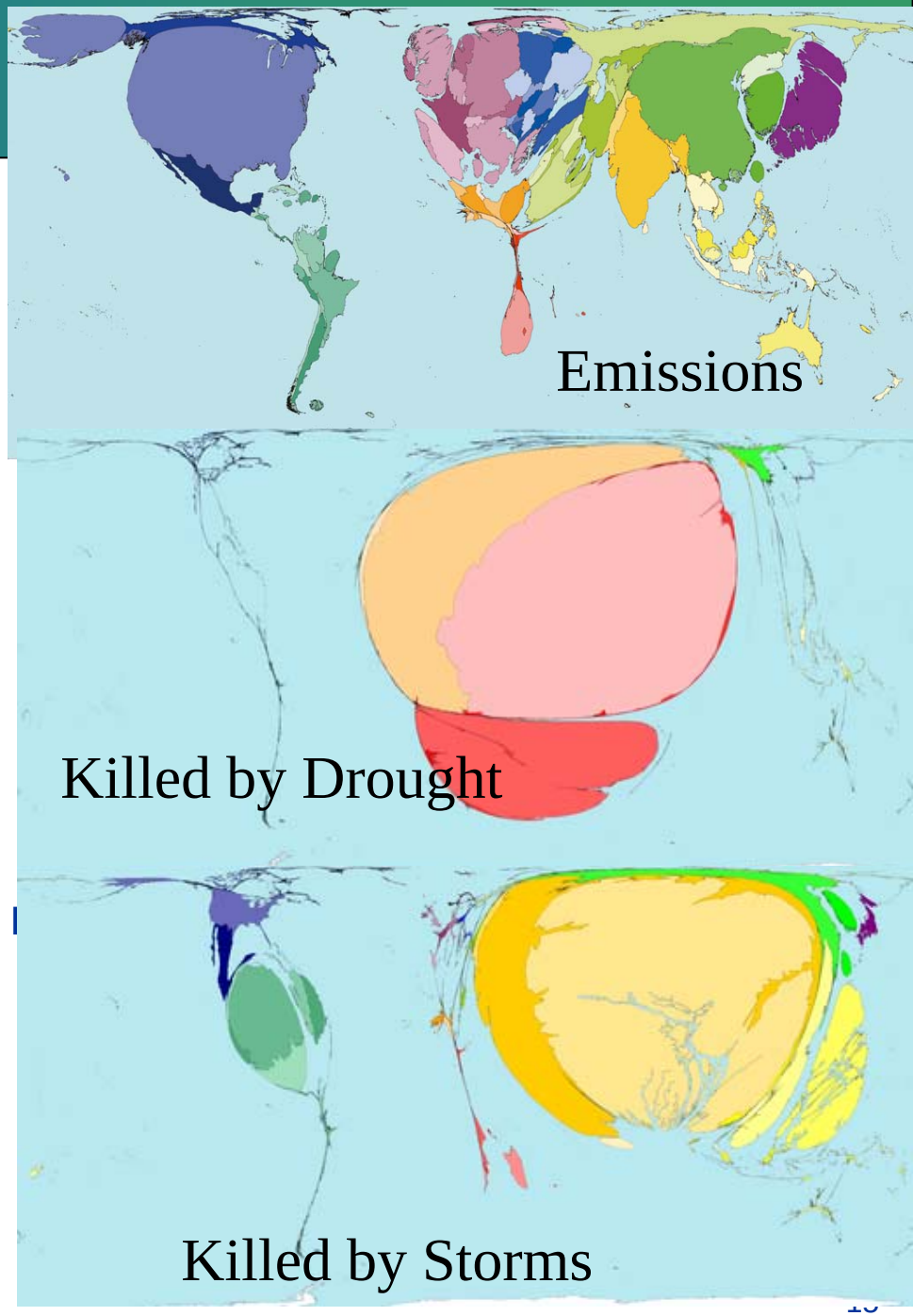
- Food and water-borne diseases
  - Heat increases organism (bacterial) growth
  - Harmful algal blooms (red tides)
    - Increase with increased water temperature
    - Increase with nutrient runoff
- Declining crop yields
- Increased food borne illness
- Increasing water shortages
- Displacement due to storms, sea-level rise

Social and economic impacts

- Health impacts related to stresses on communities
- Loss of income and productivity
- Social disruption
- Diminished quality of life
- Climate refugees and immigrant health
- Community displacement

Global Equity

- Impact greatest in developing world:
  - ID mortality (burden, impact); limited resources
- Impact in developing world will affect developed world
  - Migration, unrest and conflict, lower economic development
- Global equity
  - US = 5% pop, 28% GHGs in atmosphere
  - Natural debt per capita: US 135 tons C vs India 4 tons
  - Billions lack basics (e.g. electricity, adequate protein intake)



The Climate Gap

- Low-income & minority at increased risk for:
  - Heat effects
    - urban heat islands
      - more concrete, fewer trees, less green space
    - less AC, less transportation options
    - agricultural and construction work
  - Increased air pollution impacts
    - Proximity to traffic, ports
    - Higher baseline respiratory/CV illness
  - Impacts of extreme weather events
    - Think Katrina
  - Fuel poverty with rising energy costs
  - Food insecurity with rising food costs
  - Economic impacts of climate-related job loss
    - Agriculture
    - tourism

Morello-Frosch, Pastor

We are Sitting on a Ticking Bomb

- Scale of threat: global; touches all, everywhere
- Intensity of the threat: threatens all of our basic survival mechanisms -- food, water, shelter, and health.
- Scale of response: must engage every sector of society
- Timeframe for response: "…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)

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
- BOTH ARE NECESSARY.

California Climate Action

- AB 32 California Global Warming Solutions Act
- California Climate Adaptation Strategy
- Strategic Growth Council and SB375
- CDPH Climate Working Group
- Climate Action Team
  - Public Health Work Group
    - California State Agencies
    - Local Health Departments
    - Stakeholders

CAT Public Health Work Group Work Plan

- Vulnerability Assessment
- Adaptation
- Health Impact Assessments
- Surveillance
- Communication and Outreach
- Preparedness and Response
- Training and Technical Assistance
- Research
- Policy development

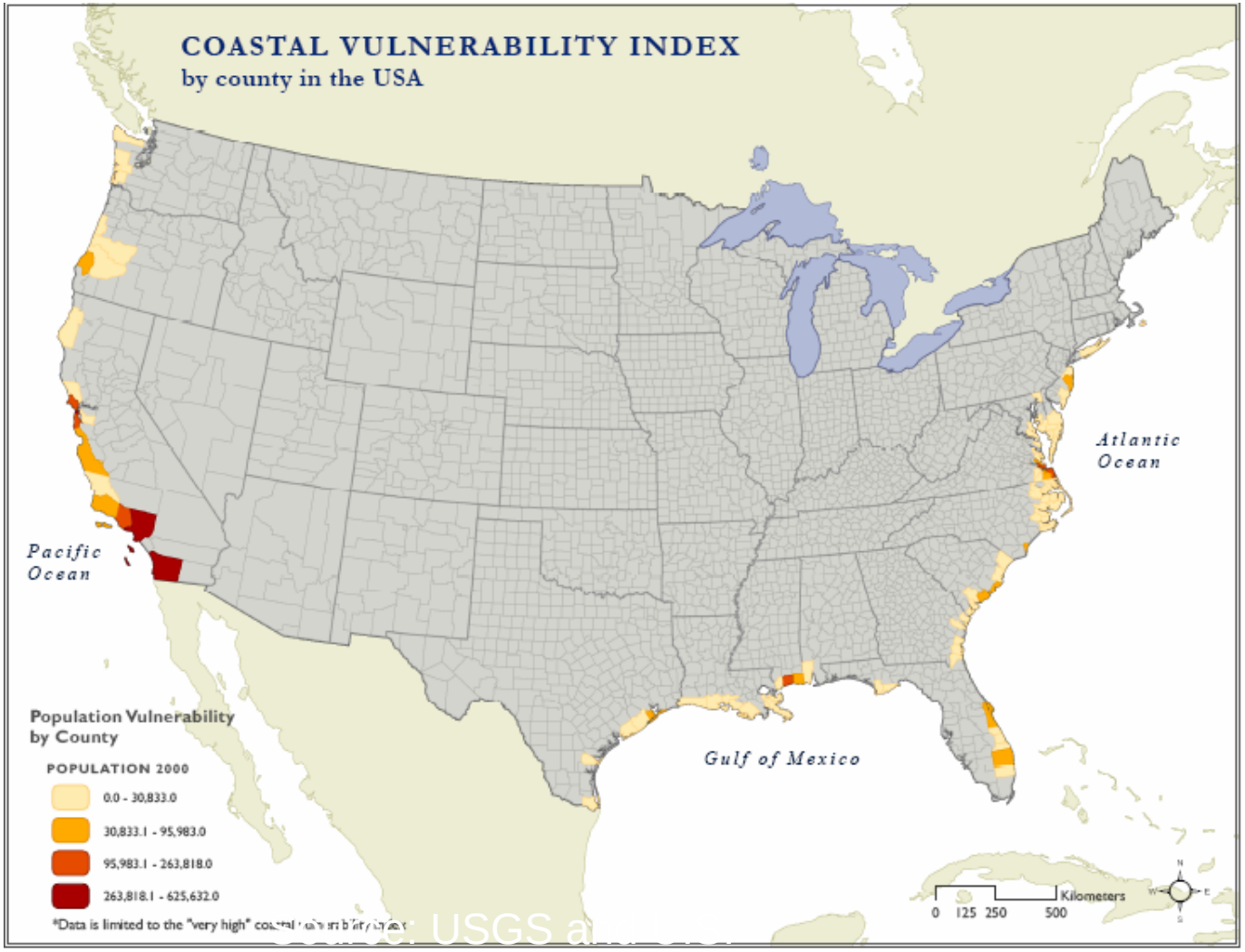
Vulnerability Assessment

- Develop and maintain in-depth and comprehensive analysis of climate change health risks and associated individual and community vulnerabilities
  - Heat
  - Stratospheric ozone depletion
  - Air pollution
  - Aero-allergens
  - Water
  - Wildfires
  - Sea level rise
  - Food supply
  - Mental health

- Downscale assessments and scenarios
  - Exposure varies by geography
  - Sensitivity varies by individual and by community
  - Preparedness, response, adaptation capacity vary by individual and by community

- Identifying more vulnerable populations - based on high probability of exposure, increased sensitivity, or lack of a capacity to adapt and prepare – is critical

Population at risk for sea level rise



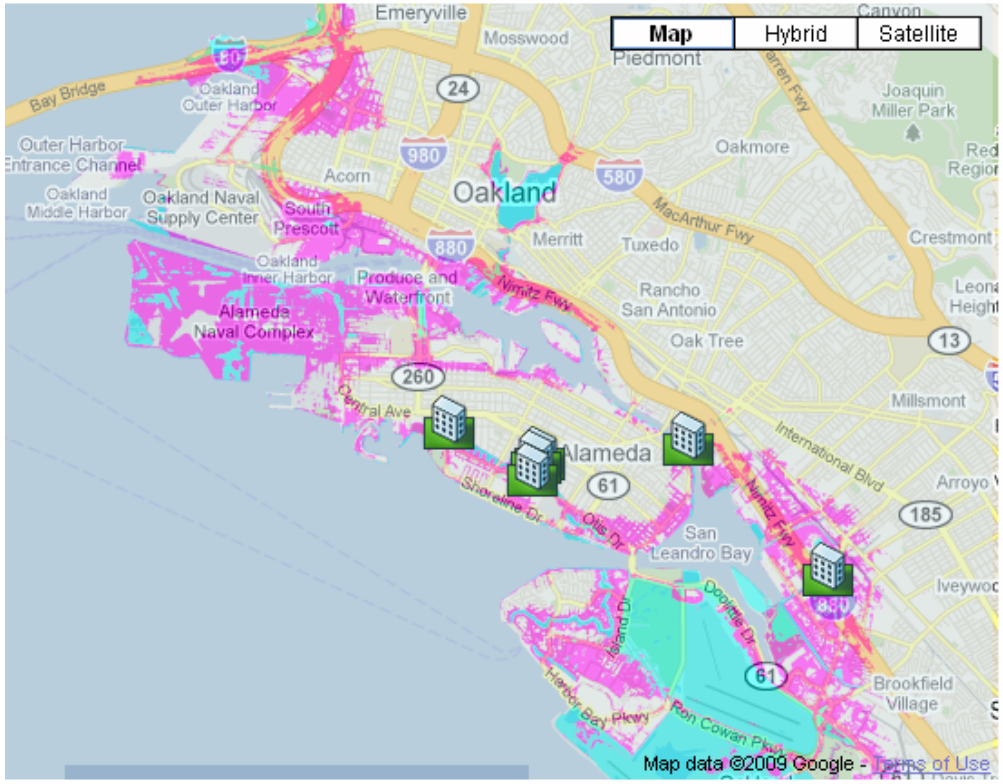
Source: USGS and US Census 2000

Hospitals at risk with sea level rise

California Coast

Pacific Institute

rosion



Hazard Zones

- [x] Area at risk from a 100-year coastal flood event
  - Current area at risk
  - Area at risk with a 1.4 meter sea-level rise
- [ ] Erosion
  - Area at risk from erosion in 2100 with a 1.4 meter sea-level rise
- [ ] Wetland Frontier
  - Areas where wetlands may migrate by 2100 if unimpeded

Data Layer Opacity

1/4 | 1/2 | 3/4 | Solid

Infrastructure at Risk

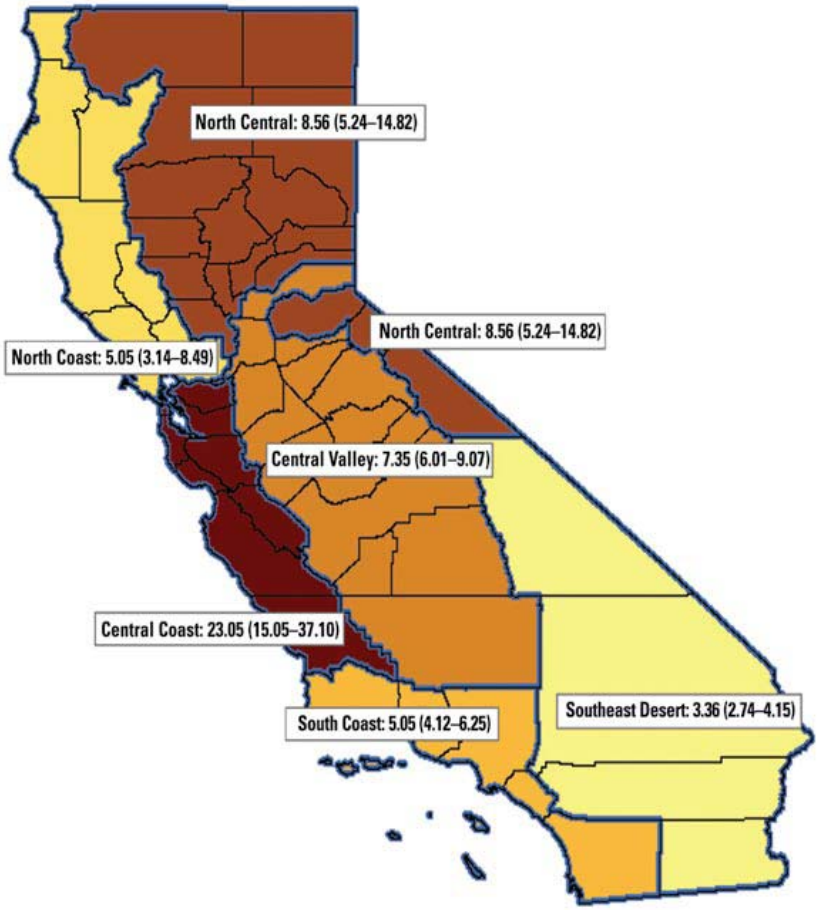
Click map icon for details

Surveillance

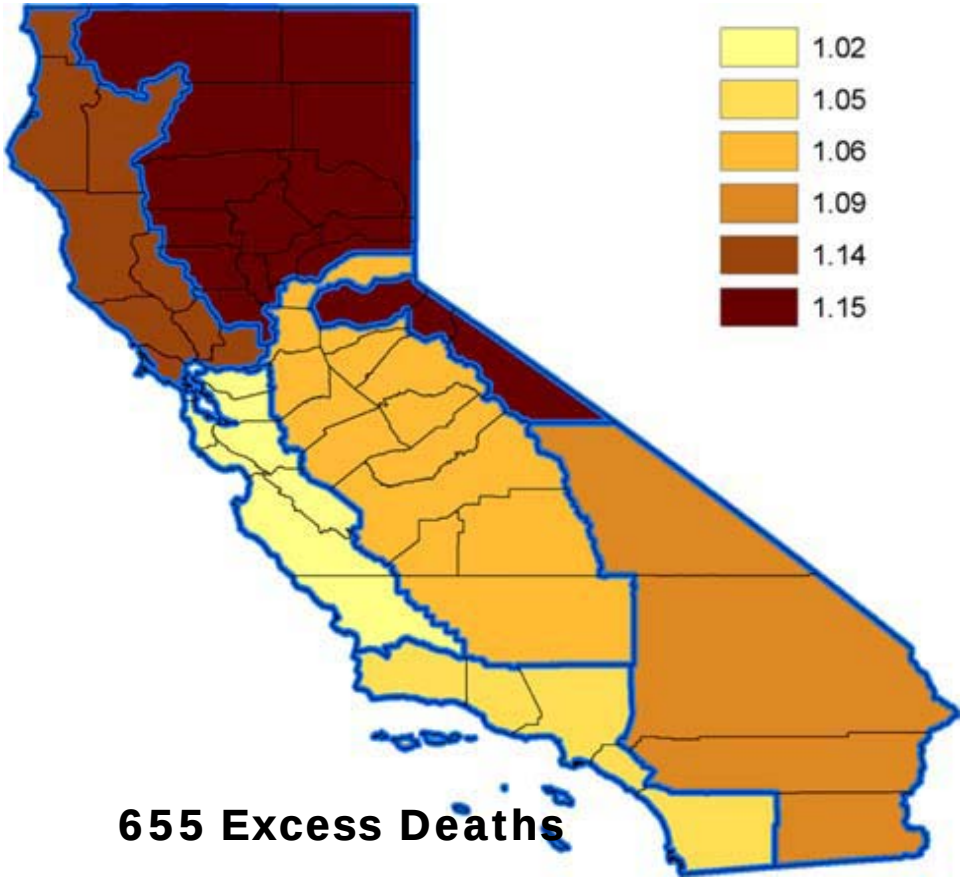
- Develop and implement robust surveillance systems to track climate change related morbidity and mortality, vulnerable populations, adaptive capacity, real-time incidence in emergencies, etc.

- CSTE State Environmental Health Indicators Framework
  - Environmental Indicators
  - Morbidity and Mortality Indicators
  - Population Vulnerability Indicators
  - Mitigation, Adaptation, and Policy Indicators

CA Heat Wave 2006: ED visit and mortality risk



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



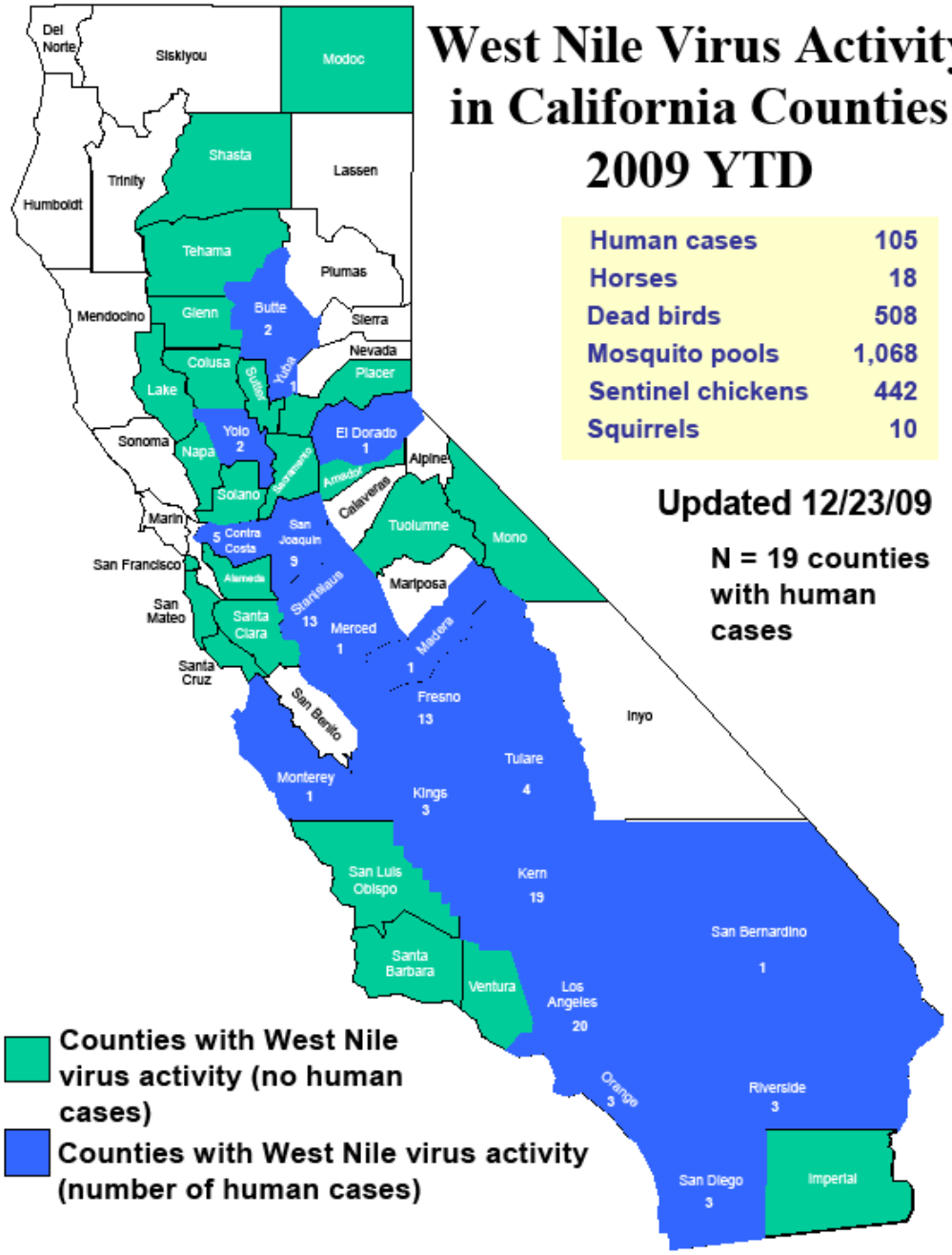
Hoshiko et.al.
http://www.springerlink.com/content/583w83502xuj0416/fulltext.pdf

West Nile Virus Activity in California Counties 2009 YTD

Human cases	105
Horses	18
Dead birds	508
Mosquito pools	1,068
Sentinel chickens	442
Squirrels	10

Updated 12/23/09

N = 19 counties with human cases



Health Inequities – the Climate Gap

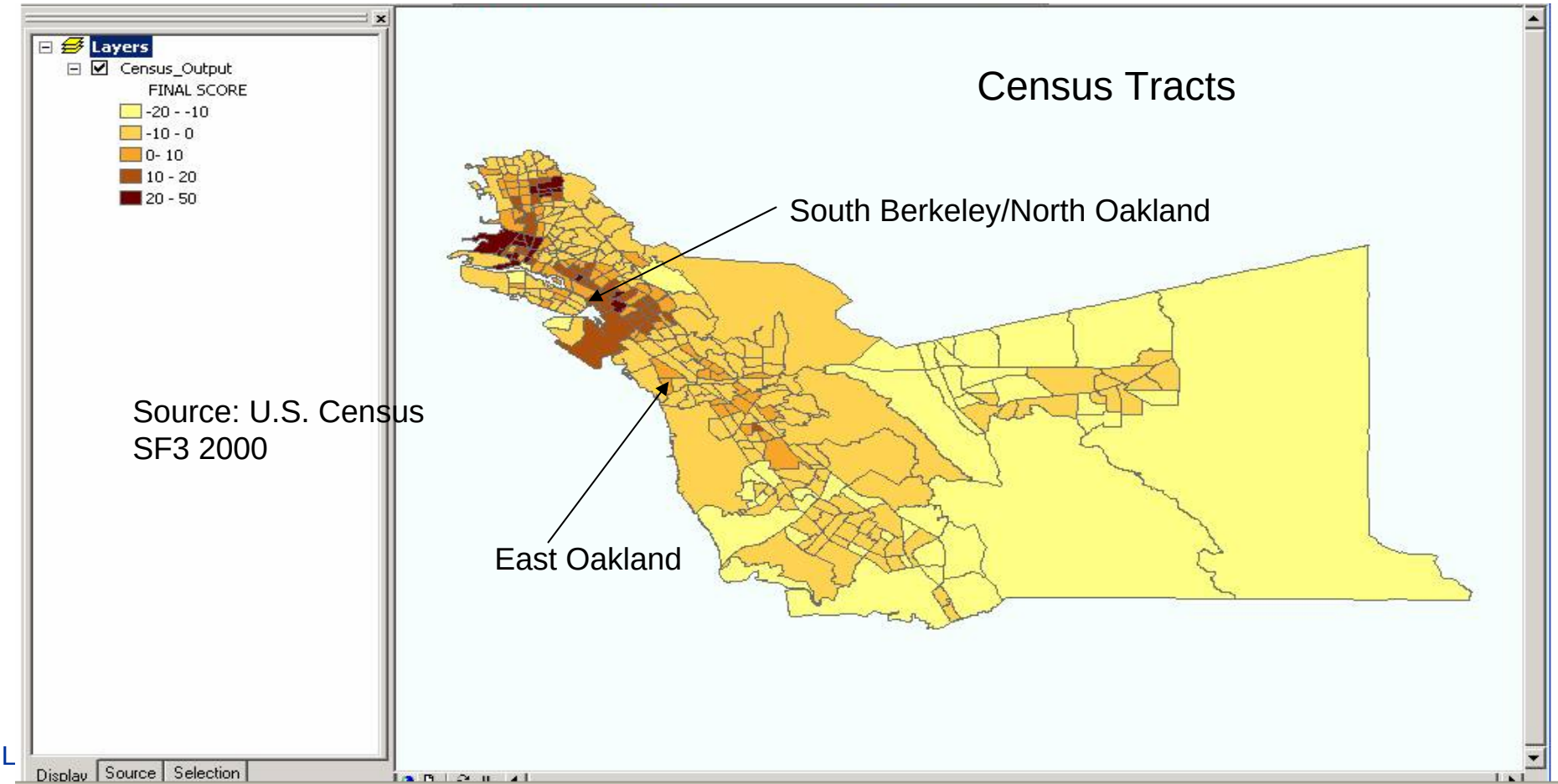
- *Heat*
  - Chronic illness - increased prevalence in low income, people of color
  - Urban heat island - low-income, people of color concentrated in urban areas, often with less tree canopy
  - Access to air-conditioning: low income, people of color less likely to have air conditioning.
  - Occupation – agricultural workers: outdoors in hot climates (e.g. Central & Imperial valleys), jobs demand physical exertion
- Air pollution
  - Air pollution levels high in poor urban neighborhoods
    - closer proximity to busy roadways & industrial pollutant sources
  - Asthma rates higher in low income and minority children in California.
  - Increases in air pollutants and/or aero-allergens may exacerbate existing health inequities
  - Recent action by the CARB to reduce diesel truck pollution is a good example of a policy that could reduce these health inequities.

Alameda County, CA, Heat Vulnerability Index

- Percent population below poverty level + percent households with elderly (65+) living alone (centered and summed)

•-20 (min; least vulnerability;

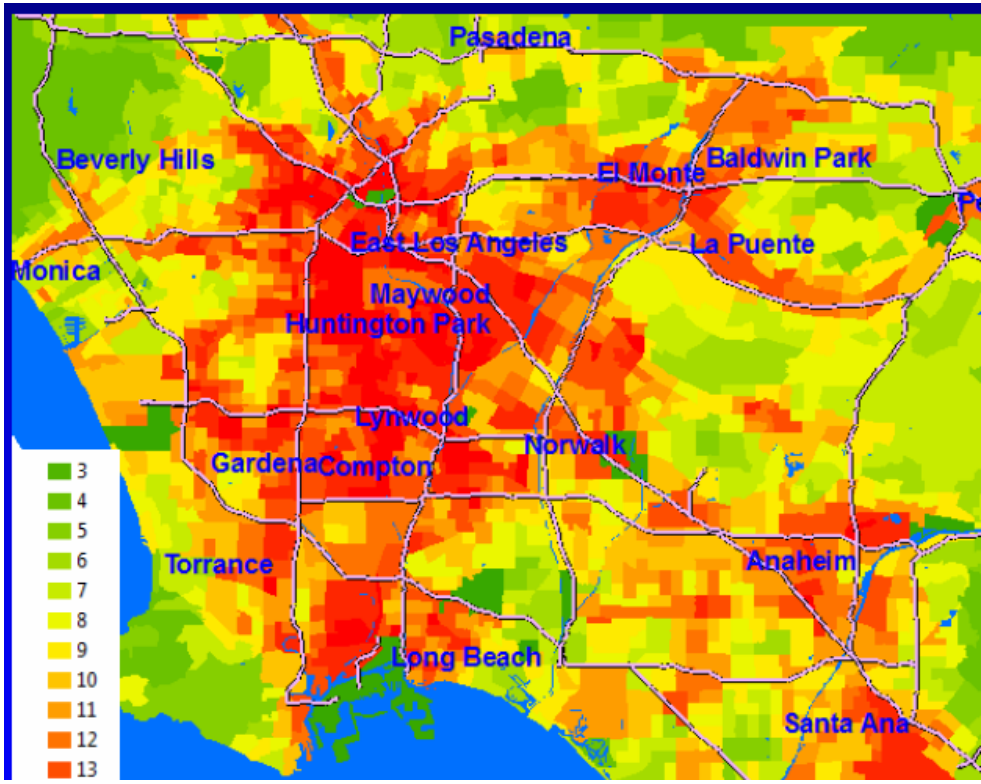
•50 (max; most vulnerability); median=-3.2



Source: U.S. Census SF3 2000

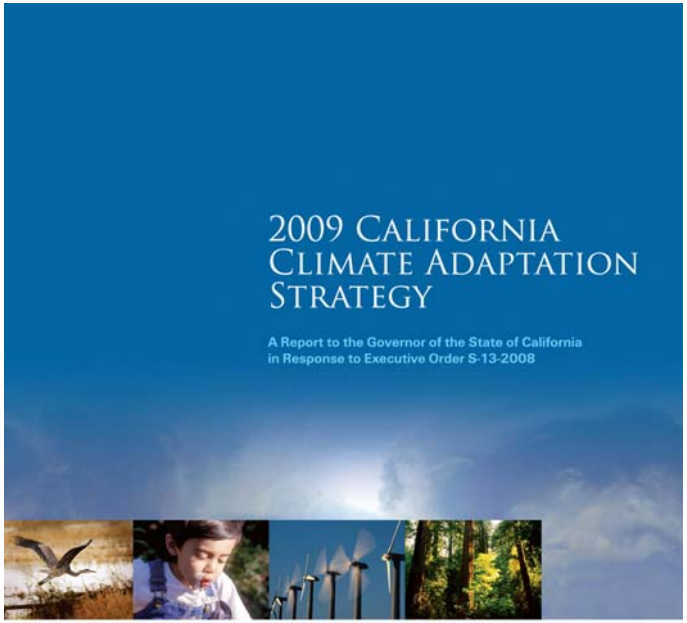
Identify vulnerable communities

- CARB EJ Screening Method (Pastor)
  - Exposures and health risks
    - Ozone, PM, air toxics, toxics release inventory
    - Modeled cancer and non-cancer risk
  - Social and Health Vulnerability
    - Race, ethnicity, poverty, education,age, homeownership, linguistic isolation, voter turnout, birth outcomes
  - Land use and hazard proximity
    - Residential land use, sensitive land uses, hazardous land uses, proximity to air pollution hazards (excludes freeway/road proximity)
- How to apply in implementation of climate policies? (e.g. cap and trade)
  -



Adaptation

- Promote healthy and resilient populations, communities, and human environments,
  - Reduce existing health and environmental inequities
  - increase preparedness for unavoidable climate change
  - increase ability to reduce greenhouse gas emissions.
- Integrate climate change mitigation and adaptation;
  - encourage adaptation strategies that maximize health co-benefits, minimize unintended consequences, and simultaneously mitigate climate change.
- Provide resources to minimize the impacts of climate change on human health and well-being.
- Increase public awareness of climate change impacts on human health, the need to prepare and need for strong actions to prevent dangerous climate change.
- Empower and engage communities for action to mitigate and adapt to climate change.
- Reduce health inequities and ensure health promotion and protection for vulnerable populations and communities.
- Identify and provide research to develop and continually refine comprehensive strategies to minimize the impacts of climate change on human health.



http://www.climatechange.ca.gov/adaptation/publichealth/2009-01-15/Public_Health_Draft_Strategies_2008-12-18.doc

Paradise: Today the AQI in Paradise is forecast to reach **375**. At this level the air quality is rated **HAZARDOUS.**

Building existing capacity of Public Health's Emergency Preparedness operations to respond to climate change related incidents and emergencies

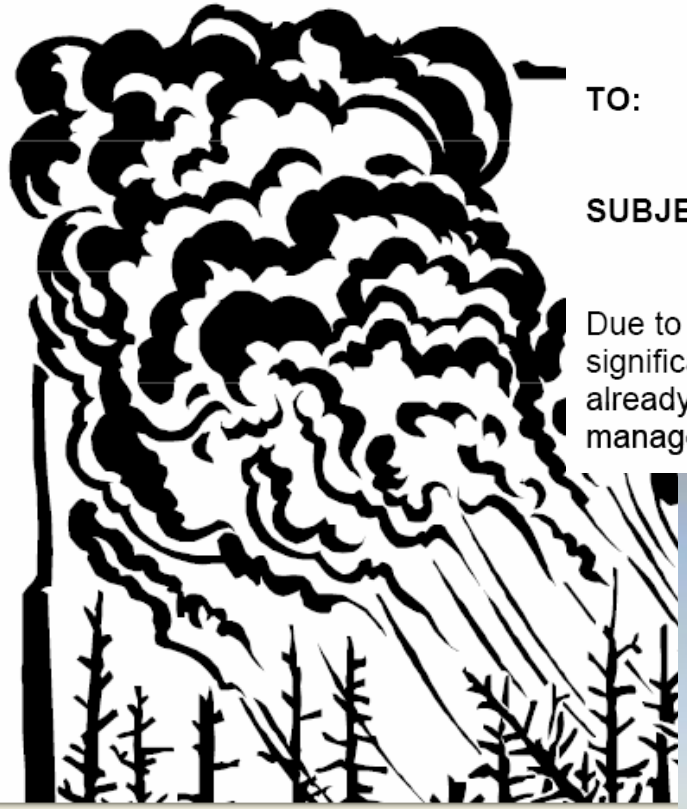
Photo from CNN http://www.cnn.com/2009/US/08/31/california.wildfires/index.html#cnnSTCPhoto

Training & Technical Assistance

Wildfire Smoke

A Guide for Public Health Officials

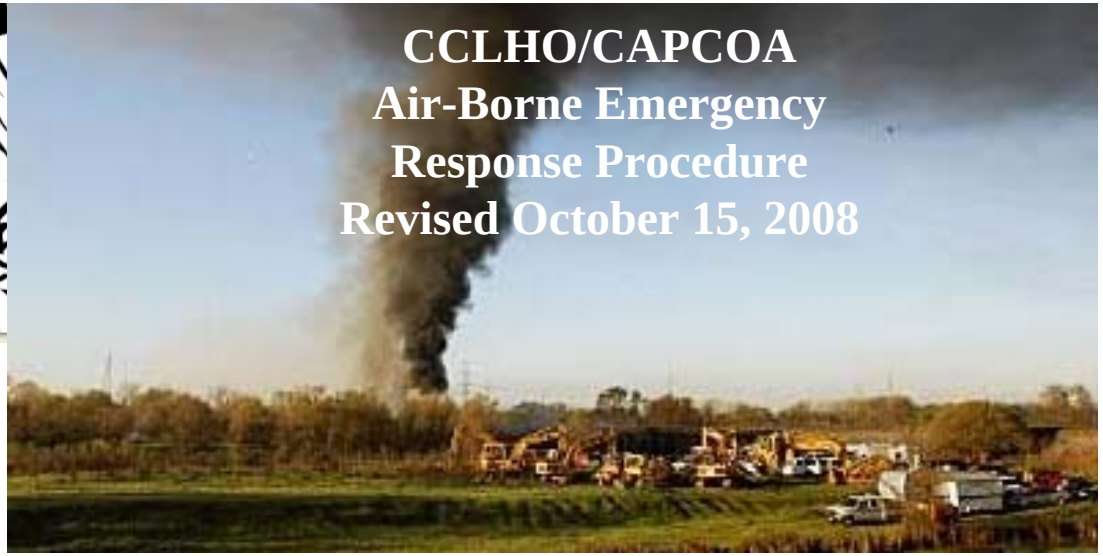
Revised July 2008



TO: All Health Facilities

SUBJECT: Health Advisory Issued Due To Wildfire Smoke

Due to the large number of wildfires in California the air quality in your vicinity may be significantly impacted. This health advisory is issued to augment the advice you may already have received from your county health officers and/or the air quality management boards.



http://www.arb.ca.gov/smp/progdev/pubeduc/wfgv8.pdf

Policy Development

- *Develop a public policy agenda to ensure promotion and institutionalization of mitigation and adaptation strategies with health co-benefits*

Cal-OSHA Heat Illness Prevention Standard

Chronic Illness and Obesity Prevention

- Education
  - Walk to school campaigns
  - School gardens
  - Healthy school breakfast/lunch
  - Daily PE all grades
  - After-school non-competitive sports
  - Restrict unhealthy food/drink sales
  - Liability protection (joint-use)
- Food & Agriculture
  - Farmers' markets
  - Community gardens
  - Labeling packaged/other foods
  - Crop subsidies fruits/veggies
- Media
  - Social marketing campaigns
  - Restrict ads for unhealthy foods
- Tax policy
  - VMT, gasoline
  - HFCS, electronic entertainment
- Housing
  - Tax credits for parks, walking trails, PE facilities
  - Transit-oriented development
- Parks & Recreation
  - Expand parks/rec facilities
- Land Use & Planning
  - Anti-sprawl measures/zoning
  - Parking access & distance
  - Fast food zoning restrictions
- Transportation
  - Expand mass transit
  - Improve bike/walk infrastructure
  - "Complete streets"
- Workplace
  - Healthy commute incentives
  - Tax credits PE opportunities
  - Healthy foods
  - Healthy behavior incentives

Climate Change, Transportation, and Injuries

- Contributes nearly 40% of California GHG emissions
- Indirect contributions (infrastructure, land use changes)
- Speed and green house gas emissions
  - Texas: (55 mph to 70 mph limit)
    - emissions increase: 23% CO, 13% NOx, 5% VOC
  - Enforcement of the 70 mph speed limit in the UK
    - save around 1 MtC (million tons of carbon) a year
- Speed and highway fatalities
  - 4300 deaths and nearly 300,000 injuries in California annual
  - 9000 fewer U.S. MVA fatalities in 1st year after 55 mph speed limit
  - restriction 65 mph or less will save almost 3,000 lives per year U.S.

Transportation Sector Mitigation Strategies & Co-Benefits

Mitigation strategies

- Fuel efficiency
- Low carbon fuels

- Reduced VMT
  - Public transit
  - Active transport
  - Land-use planning

- Reduce speed

Effects

Reduced:

- GHG emissions
- Air pollution

+

- Noise
- Community Severance
- Infrastructure cost

Increased:

- Physical Activity
- Social Capital

Health Co-Benefits

Reductions in:

- Respiratory disease
- Heart disease

+

- Traffic injuries
- Depression
- Osteoporosis
- Diabetes
- Cancer
- Stress

Active Transportation Co-Benefits

In London, more active travel would bring substantial health gains. **Heart disease and stroke could fall by 10–20%, with reductions in breast cancer (12–13%), dementia (8%), and depression (5%).** Combining increased active travel with low-emission vehicles would bring greater benefits by further reducing air pollution.

Woodcock: Lancet, Nov 2009

Climate Change, Agriculture, Diet & Health

- Agricultural activity contributes 22% total GHGs
  - Fertilizers (NOx), CAFO (methane), burning, transport, deforestation
  - 80% global ag emissions: livestock production
- Meat consumption:
  - World meat consumption will double by 2050 Average
  - American diet produces extra 1.5 CO_2e vs. vegetarian diet
  - 2.2 pounds beef = CO_2e of 155 miles driving
  - Increased risks of CV disease, obesity, colorectal cancer, breast cancer, prostate cancer
- Food production
  - 17% fossil fuel use in U.S. for food production
  - Up to 40% energy in food production: artificial fertilizers and pesticides
  - Average food miles: 1500
- Health benefits of urban agriculture
  - Nutrition (increase consumption fresh produce) & food security
  - Increase physical activity w/ associated health benefits
  - Mental health (e.g. social networking, social cohesion)
  - Safe places in neighborhoods

Small changes – big impacts – win-win

10 pounds of CO2

1 pound of CO2

Increased risk: CV disease, obesity, colorectal cancer, breast cancer, prostate cancer

A 30% fall in the adult consumption of saturated fat from animal sources would reduce heart disease in the population by around 15% in the UK.

Fried: Lancet, Nov 2009

Health Impact Assessments

- Guidelines for HIA
  - Draft undergoing revision (R.Bhatia)
- Assess co-benefits, potential adverse consequences of proposed mitigation and adaptation strategies
  - Cap and trade – in progress
  - Other adopted mitigation strategies?
    - renewable energy, low carbon fuels
  - Strategies not included in AB32 Scoping Plan?
    - speed reduction, reduced meat consumption
  - Adaptation strategies?
    - rain water storage, urban forestry

Climate & Health Benefits of Sustainable Agriculture

Reductions

- Greenhouse gas emissions
- Pesticide use
- Synthetic fertilizer use
- Food miles
- Antibiotic use
- Water pollution (nitrates)
- Air pollution
- Biodiversity loss
- Soil erosion
- Unsustainable H2O consumption

Increases

- Local food systems
- Rural community strength

Reductions

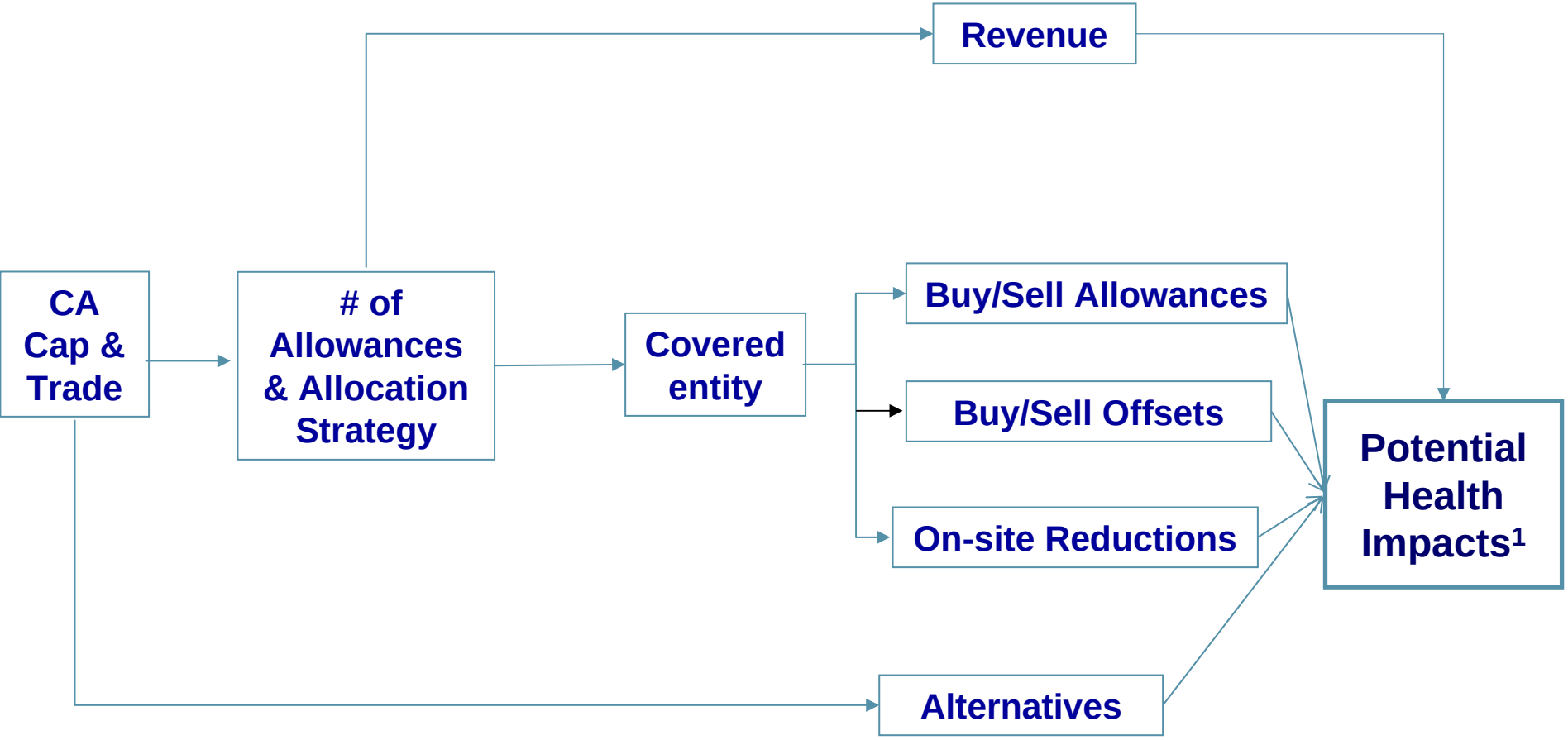
- Ischemic heart disease
- Obesity
- Colorectal cancer
- Breast & prostate cancers
- Type II Diabetes
- Antibiotic resistance
- Respiratory disease
- Pesticide health effects

California Strategic Growth Council

- BTH, CalEPA, Resources, CHHSA, OPR
- Coordinate activities of state agencies
  - Air & water quality, natural resources, affordable housing, transportation, public health
  - Assist local/state entities meet AB 32 goals
- SGC Grants to local government agencies
  - Sustainable Communities planning, urban greening
- CDPH participation in grant RFA development:

  How will you promote public health & healthy communities?
  - Extent and nature of coordination/collaboration with local health officer/health department?
  - How does proposal address definition of a healthy community?
  - How will public health co-benefits and potential adverse health consequences be identified? Approach to mitigating or preventing potential adverse consequences?

Cap & Trade HIA: Overview of Components



[1]Potential health impacts can be positive, negative or neutral

Communication and Outreach

- Develop general and vulnerable population risk communication messaging :
  - Climate change and health
  - Climate change mitigation and heatlh co-benefits
  - Adaptation
  - Preparedness
- Build on public health experience with social norms change

Healthy People
CDPH
California Department of
PublicHealth
Healthy Planet
Healthy Communities