Sustainable Cities and Public Health

Transitioning to Sustainability:
The Challenge of Developing Sustainable Urban Systems

The National Academies' Second Sustainability R&D Forum
September 23, 2009

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National Center for Environmental Health /
Agency for Toxic Substances and Disease Registry
Centers for Disease Control and Prevention

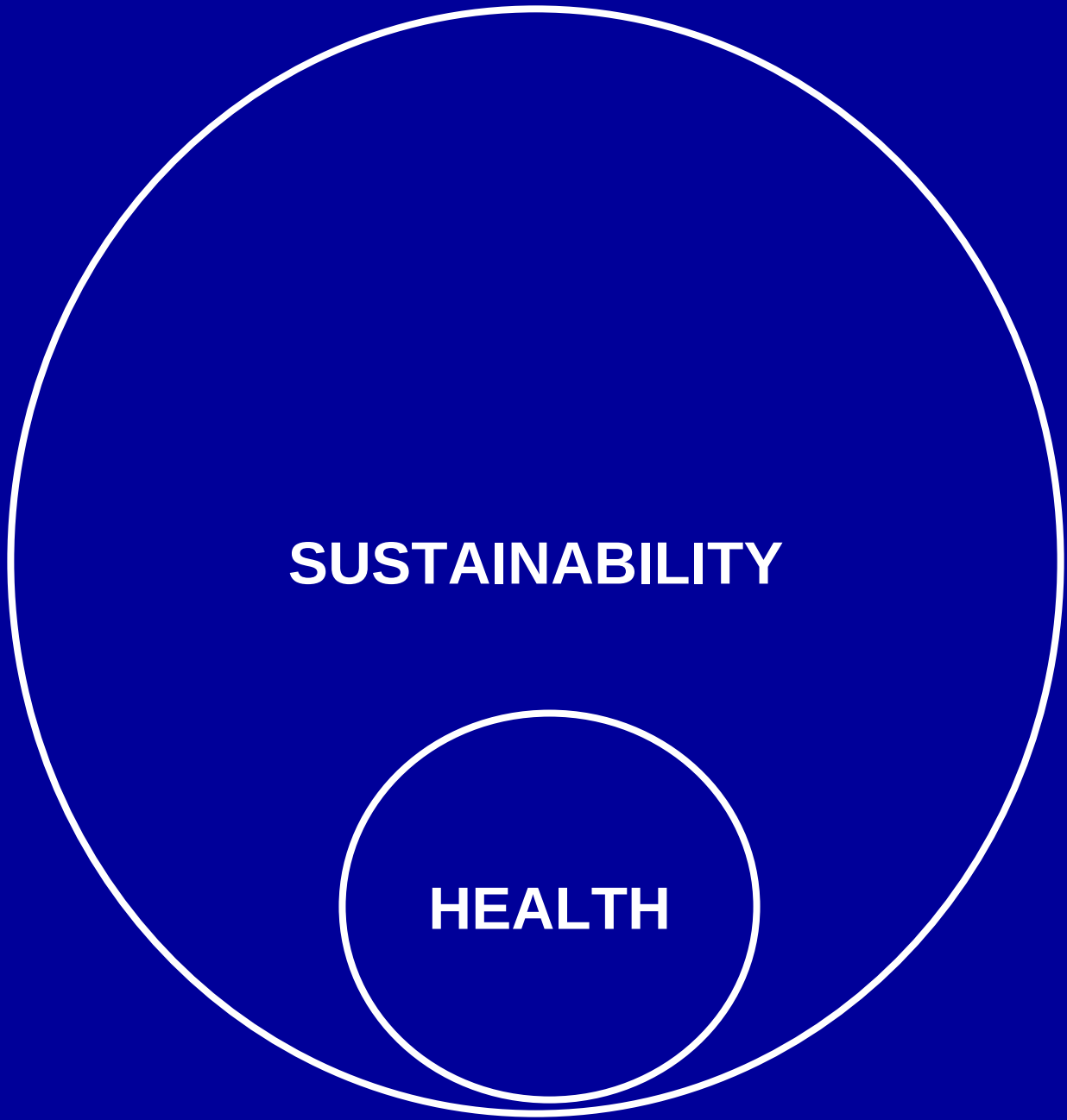
Sustainable Cities and Health: Three Propositions

- Human health is intrinsic to sustainability
- The practice of sustainability offers multiple co-benefits including promoting health
- Healthy community design requires needs assessment, good design, and follow-up

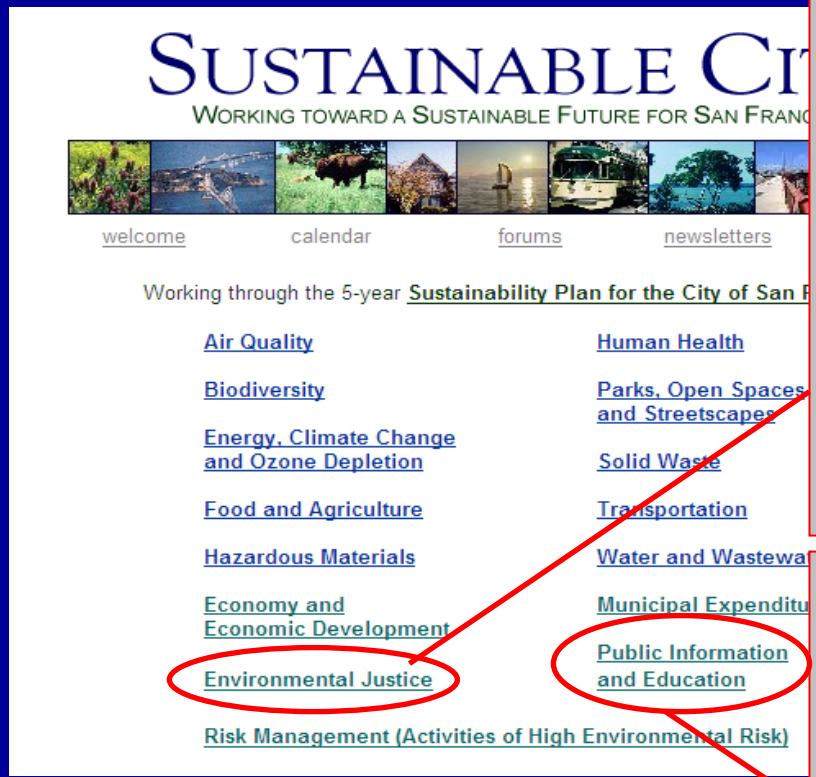
Sustainability and Health

- Sustainability: meeting the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland Commission, 1987).

- UNCED Principle 1: “Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature.”

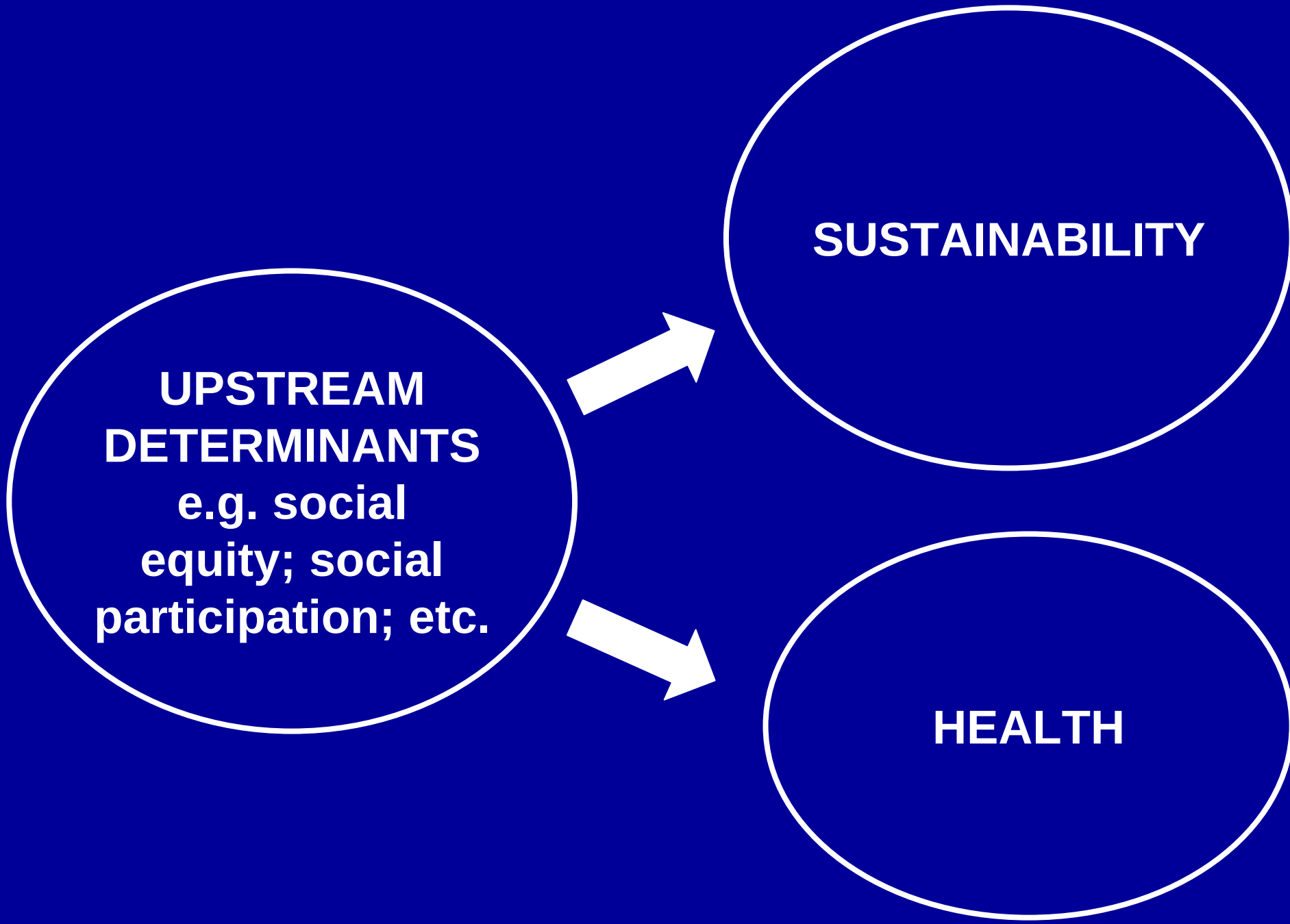

SUSTAINABILITY
HEALTH

Social dimensions of sustainability



- Mean income level of people in historically disadvantaged communities.
- Proportion of … pollution sources in historically disadvantaged communities
- Participation of historically disadvantaged communities … in decision-making processes..

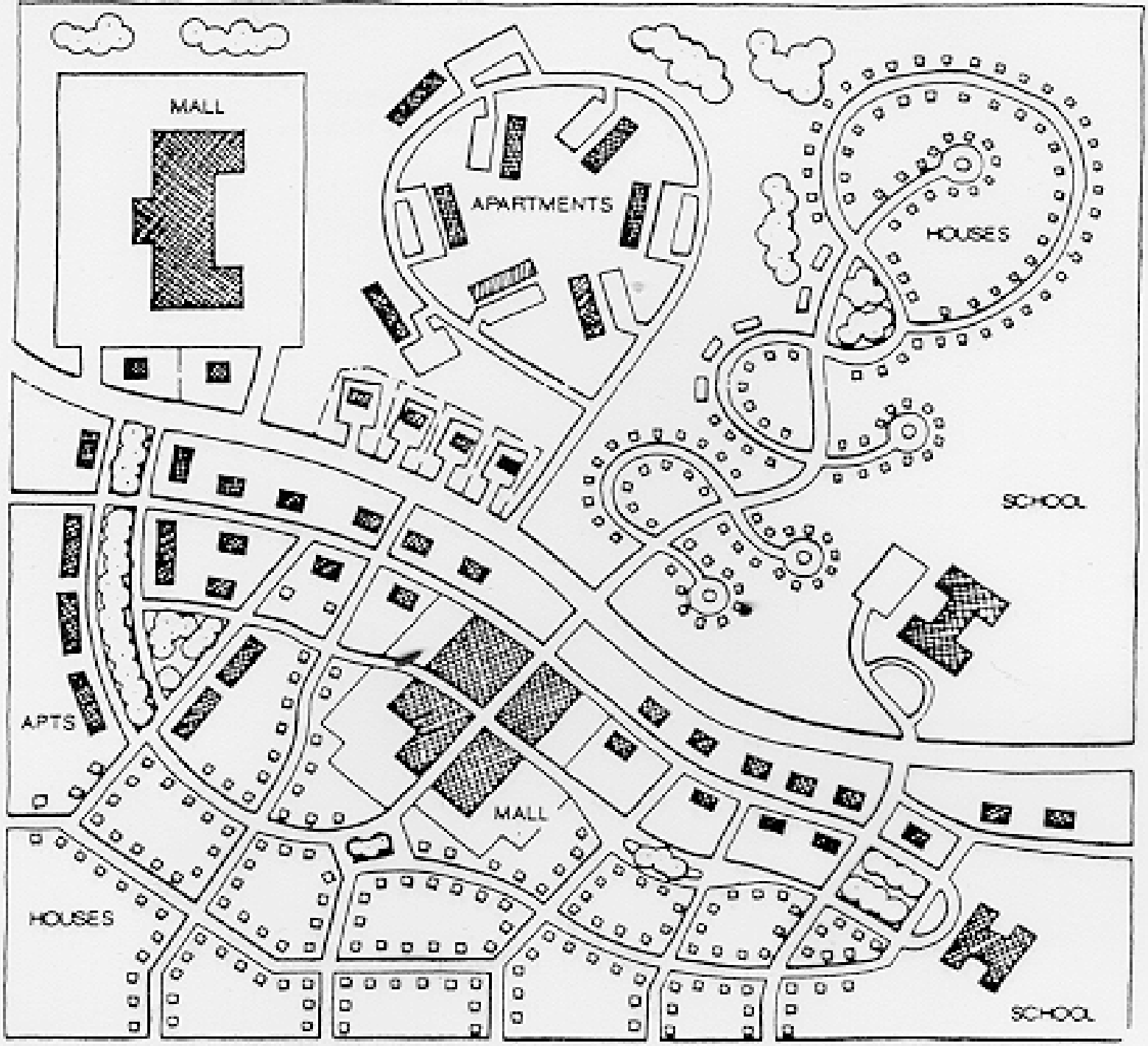
- Number of schools that integrate … environmental education in their curricula.
- Number of volunteers working on environmental projects …


UPSTREAM DETERMINANTS e.g. social equity; social participation; etc.
SUSTAINABILITY
HEALTH

Urban Sustainability and Health: Synergies in Practice

1. Land use
2. Transportation
3. Food
4. Greenspace
5. Climate change mitigation and adaptation

1. Land Use


MALL
APARTMENTS
HOUSES
SCHOOL
APTS
MALL
HOUSES
SCHOOL

Land Use Practices

- Density
- Mixed use
- Connectivity
- Strong activity centers
- “Third spaces”

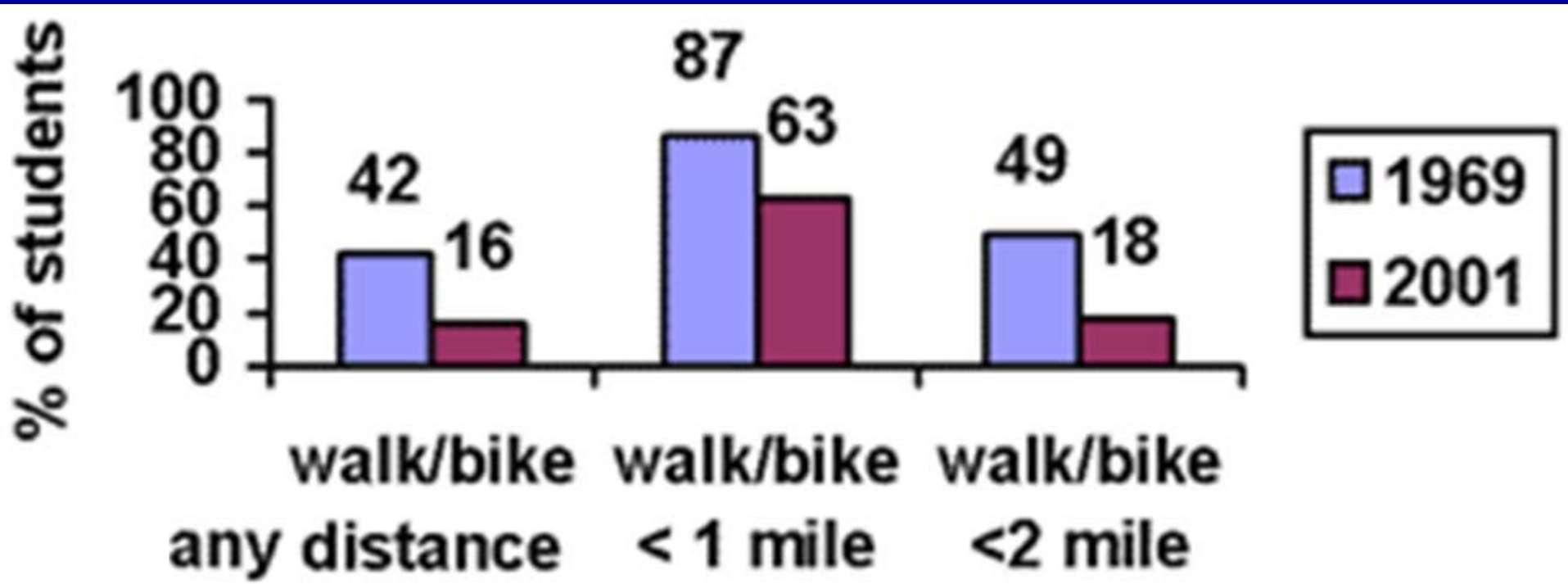
Sustainable practices = healthy practices

2. Transportation

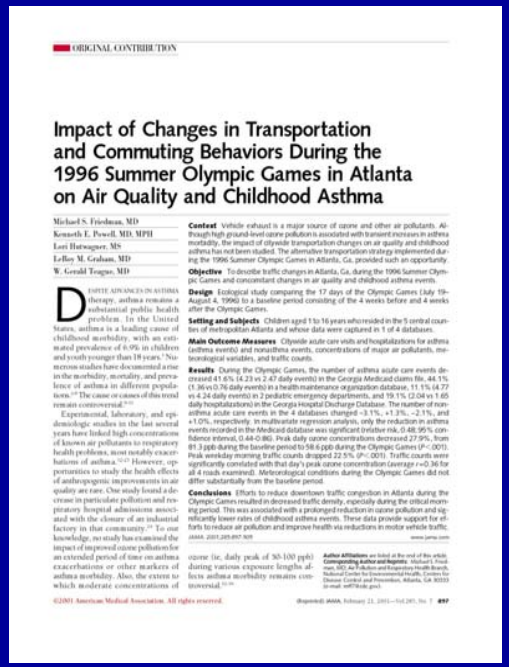
Travel demand: School siting

Hubbard Lake Elementary School
Hubbard Lake, Michigan
"Outstanding in Its Field"

Active transport to school, 1969 and 2001



Air quality benefits



ORIGINAL CONTRIBUTION

Impact of Changes in Transportation and Commuting Behaviors During the 1996 Summer Olympic Games in Atlanta on Air Quality and Childhood Asthma

Michael S. Friedman, MD
Kenneth E. Powell, MD, MPH
Lori Hutwagner, MS
LeRoy M. Graham, MD
W. Gerald Teague, MD

Context Vehicle exhaust is a major source of ozone and other air pollutants. Although high ground-level ozone pollution is associated with transient increases in asthma morbidity, the impact of citywide transportation changes on air quality and childhood asthma has not been studied. The alternative transportation strategy implemented during the 1996 Summer Olympic Games in Atlanta, Ga, provided such an opportunity.

Objective To describe traffic changes in Atlanta, Ga, during the 1996 Summer Olympic Games and concomitant changes in air quality and childhood asthma events.

Design Ecological study comparing the 17 days of the Olympic Games (July 19–August 4, 1996) to a baseline period consisting of the 4 weeks before and 4 weeks after the Olympic Games.

Setting and Subjects Children aged 1 to 16 years who resided in the 5 central counties of metropolitan Atlanta and whose data were captured in 1 of 4 databases.

Main Outcome Measures Citywide acute care visits and hospitalizations for asthma (asthma events) and nonasthma events, concentrations of major air pollutants, meteorological variables, and traffic counts.

Results During the Olympic Games, the number of asthma acute care events decreased 41.6% (4.23 vs 2.47 daily events) in the Georgia Medicaid claims file, 44.1% (1.36 vs 0.76 daily events) in a health maintenance organization database, 11.1% (4.77 vs 4.24 daily events) in 2 pediatric emergency departments, and 19.1% (2.04 vs 1.65 daily hospitalizations) in the Georgia Hospital Discharge Database. The number of nonasthma acute care events in the 4 databases changed −3.1%, +1.3%, −2.1%, and +1.0%, respectively. In multivariate regression analysis, only the reduction in asthma events recorded in the Medicaid database was significant (relative risk, 0.48; 95% confidence interval, 0.44-0.86). Peak daily ozone concentrations decreased 27.9%, from 81.3 ppb during the baseline period to 58.6 ppb during the Olympic Games ($P<.001$). Peak weekday morning traffic counts dropped 22.5% ($P<.001$). Traffic counts were significantly correlated with that day's peak ozone concentration (average $r=0.36$ for all 4 roads examined). Meteorological conditions during the Olympic Games did not differ substantially from the baseline period.

Conclusions Efforts to reduce downtown traffic congestion in Atlanta during the Olympic Games resulted in decreased traffic density, especially during the critical morning period. This was associated with a prolonged reduction in ozone pollution and significantly lower rates of childhood asthma events. These data provide support for efforts to reduce air pollution and improve health via reductions in motor vehicle traffic.

JAMA. 2001;285:897-905
www.jama.com

ozone (ie, daily peak of 80-100 ppb) during various exposure lengths affects asthma morbidity remains controversial.[10-19]

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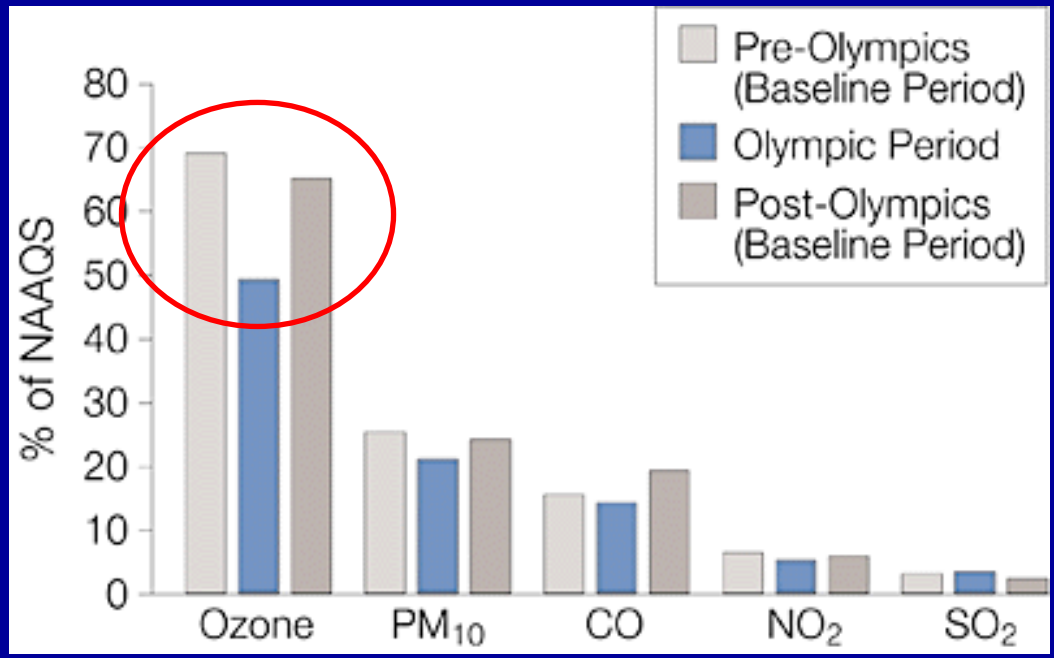
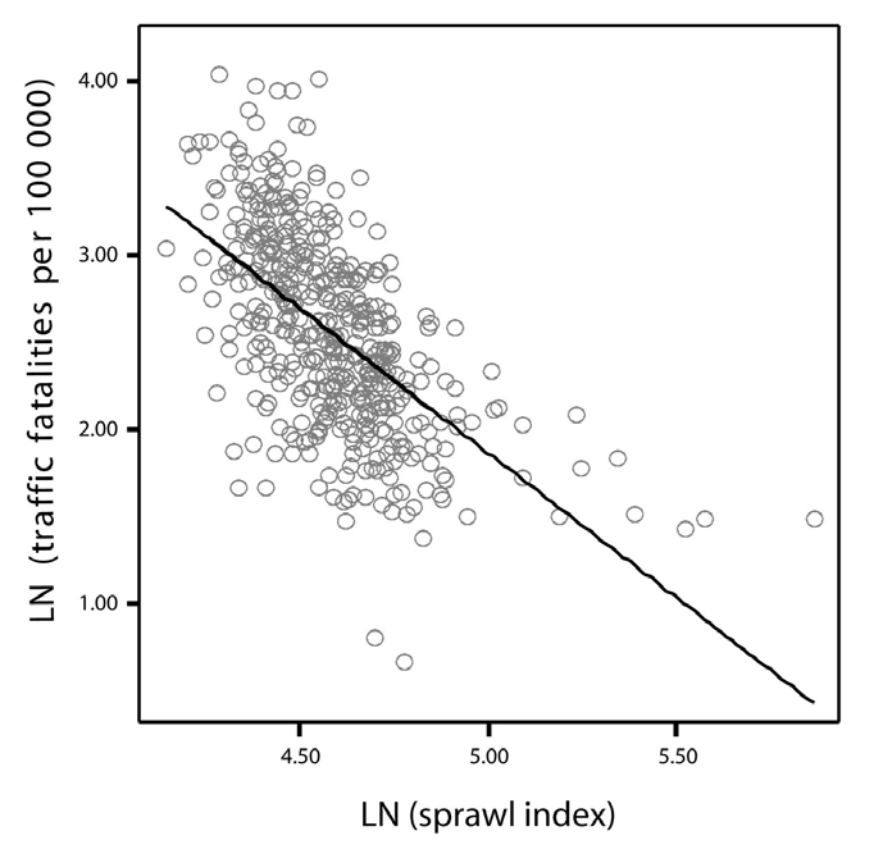


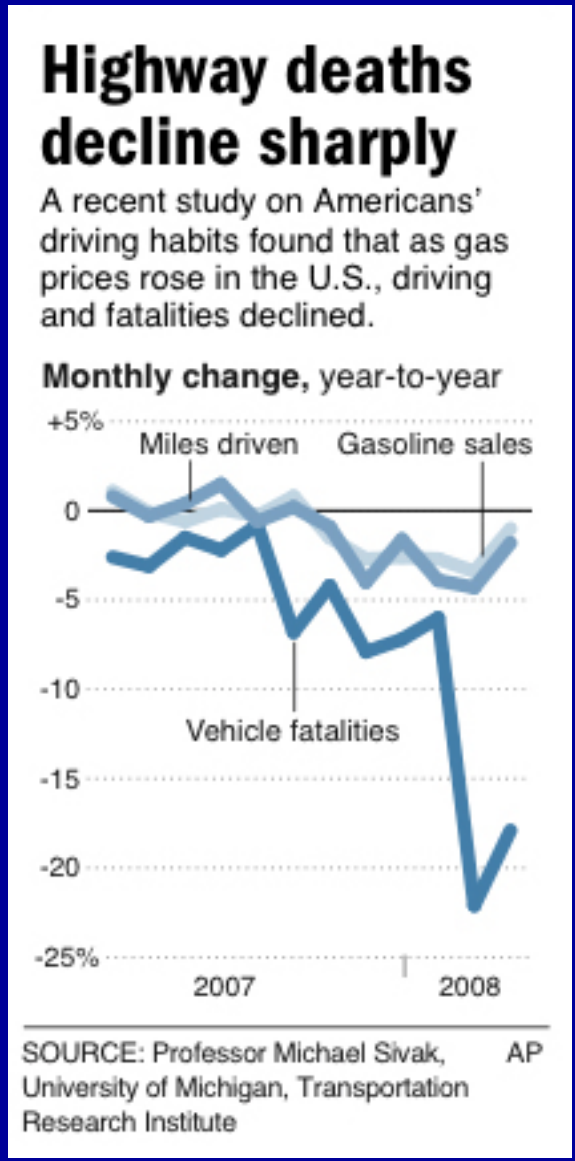
Peak traffic ↓ 23%
Peak ozone ↓ 28%
Asthma emergencies ↓ 11-44%

Friedman et al. *JAMA* 2001;285:897-905

Less driving, fewer fatalities



Ewing et al. *Am J Public Health* 2003;93:1541-45



Sivak. UMTRI-2008-39, July 2008

Transit and physical activity

- Transit users walk a median of 19 minutes daily to and from transit
- 29% exceed 30 minutes of physical activity daily

Besser and Dannenberg, *Am J Prev Med* 2005

Transportation Practices

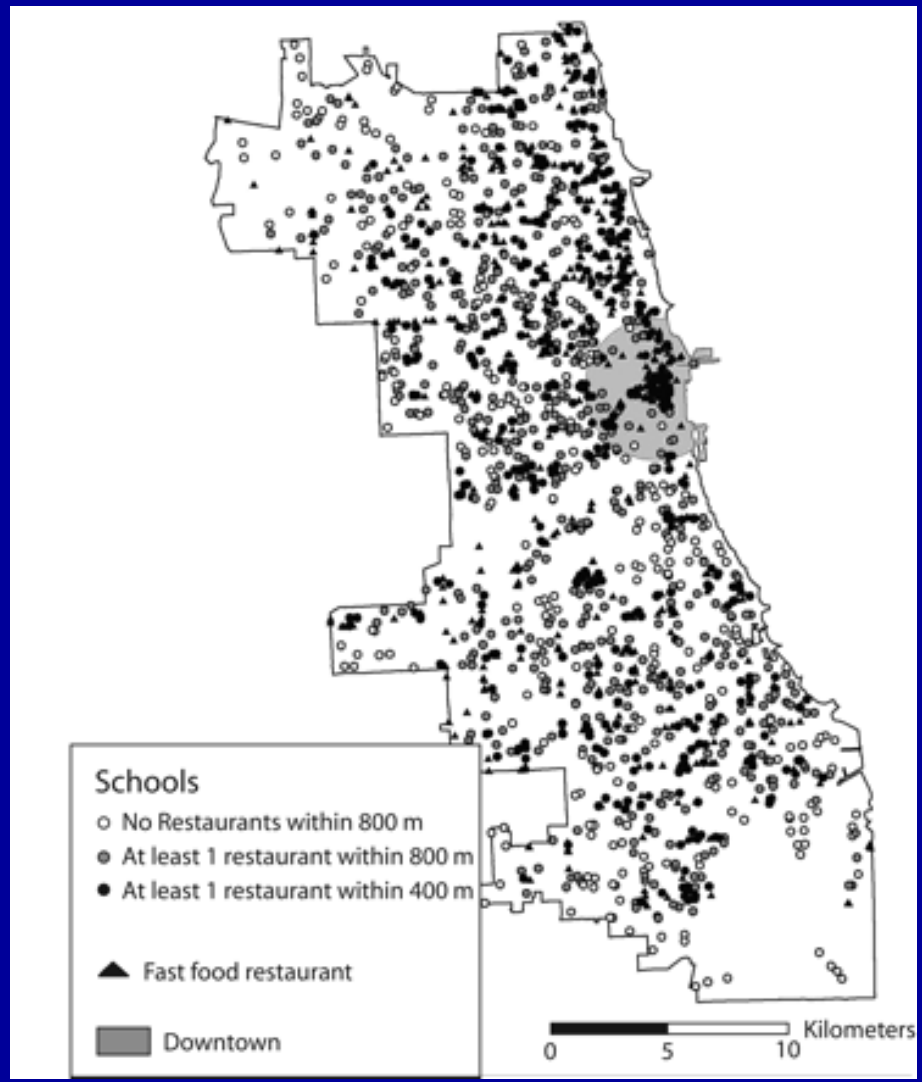
- Reduced travel demand
- Pedestrian and bicycle infrastructure
- Transit

Sustainable practices = healthy practices

3. Food

Fast Food Near Schools

- Median distance from any Chicago school to nearest fast-food restaurant: 0.52 km
- 78% of schools had at least 1 fast-food restaurant within 800 m
- Fast-food restaurants clustered near schools (3-4X as many as expected)



Fresh food access

Livestock production

Food, livestock production, energy, climate change, and health

Anthony J McMichael, John W Powles, Colin D Butler, Ricardo Uauy

Food provides energy and nutrients, but its acquisition requires energy expenditure. In post-hunter-gatherer societies, extra-somatic energy has greatly expanded and intensified the catching, gathering, and production of food. Modern relations between energy, food, and health are very complex, raising serious, high-level policy challenges. Together with persistent widespread under-nutrition, over-nutrition (and sedentarism) is causing obesity and associated serious health consequences. Worldwide, agricultural activity, especially livestock production, accounts for about a fifth of total greenhouse-gas emissions, thus contributing to climate change and its adverse health consequences, including the threat to food yields in many regions. Particular policy attention should be paid to the health risks posed by the rapid worldwide growth in meat consumption, both by exacerbating climate change and by directly contributing to certain diseases. To prevent increased greenhouse-gas emissions from this production sector, both the average worldwide consumption level of animal products and the intensity of emissions from livestock production must be reduced. An international contraction and convergence strategy offers a feasible route to such a goal. The current global average meat consumption is 100 g per person per day, with about a ten-fold variation between high-consuming and low-consuming populations. 90 g per day is proposed as a working global target, shared more evenly, with not more than 50 g per day coming from red meat from ruminants (ie, cattle, sheep, goats, and other digastric grazers).

Lancet 2007; 370: 1253–63
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This is the fifth in a Series of six papers about energy and health

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Introduction

Food provides energy and nutrients, and its acquisition requires the expenditure of energy. In post-hunter-gatherer societies, with progressively increasing inputs of extra-somatic energy, the scale of catching, gathering, and producing food has been greatly expanded and methods intensified. Today, relations between energy, food, and health have become complex and multifaceted, raising serious policy concerns at national and international levels.

Substantial and widespread public-health problems of under-nutrition and over-nutrition exist—often coexisting within the same population. Meanwhile, the world's agricultural sector, especially livestock production, accounts for about a fifth of total greenhouse-gas emissions, thus contributing to climate change and its effects on health, including on regional food yields. Policy responses to the connections between food production, energy, climate, and health should include countering the world's rapidly increasing consumption of meat, which poses health risks by exacerbating climate change and by direct contribution to the causation of certain diseases. These linkages are explored in this paper, and recommendations for policy are made.

The story of world food production and associated changes in population health over recent centuries comprises both good and bad news. There is much good news: food production capacity has increased greatly; maternal and child nutrition in high-income populations and groups has improved; health and life expectancies have increased, at least partly because of nutritional gains; and refrigeration, transport, and open markets have increased year-round access to healthy foods for many populations.

Meanwhile, health risks are also accruing: the expansion of food production is depleting land cover and biodiversity, with diverse consequences for human wellbeing and health; major elemental cycles are being disrupted (eg, fertiliser use has vastly increased the concentration of bioactive nitrogen compounds in the global environment); industrial food refining, marketing, and over-consumption increase the risks of some non-communicable diseases; and fossil fuel inputs to modern food systems, together with other

Key messages

- Greenhouse-gas emissions from the agriculture sector account for about 22% of global total emissions; this contribution is similar to that of industry and greater than that of transport. Livestock production (including transport of livestock and feed) accounts for nearly 80% of the sector's emissions
- Methane and nitrous oxide (which are both potent greenhouse gases and closely associated with livestock production) contribute much more to this sector's warming effect than does carbon dioxide
- Halting the increase of greenhouse-gas emissions from agriculture, especially livestock production, should therefore be a top priority because it could curb warming fairly rapidly. However, livestock production is projected, on current trends, to increase substantially over the next four decades, mainly in countries of low or middle income
- Available technologies for reduction of emissions from livestock production, applied universally at realistic costs, would reduce non-carbon dioxide emissions by less than 20%. We therefore advocate a contraction and convergence strategy to reduce consumption of livestock products, mirroring the widely supported strategy proposed for greenhouse-gas emissions in general. Contraction of consumption in high-income countries per head would then define the lower, common, ceiling to which low-income and middle-income countries could also converge

(Continues on next page)

ORIGINAL INVESTIGATION

Meat Intake and Mortality

A Prospective Study of Over Half a Million People

Rashmi Sinha, PhD; Amanda J. Cross, PhD; Barry I. Graubard, PhD; Michael F. Leitzmann, MD, DrPH; Arthur Schatzkin, MD, DrPH

EDITORIAL

Reducing Meat Consumption Has Multiple Benefits for the World's Health

time. Meat intake was estimated from a food frequency questionnaire administered at baseline. Cox proportional hazards regression models estimated hazard ratios (HRs) and 95% confidence intervals (CIs) within quintiles of meat intake. The covariates included in the models were age, education, marital status, family history of cancer (yes/no) (cancer mortality only), race, body mass index, 31-level smoking history, physical activity, energy intake, alcohol intake, vitamin supplement use, fruit consumption, vegetable consumption, and menopausal hormone therapy among women. Main outcome measures included total mortality and deaths due to cancer, cardiovascular disease, injuries and sudden deaths, and all other causes.

Results: There were 47 976 male deaths and 23 276 female deaths during 10 years of follow-up. Men and women

1.19], and HR, 1.11 [95% CI 1.04-1.19], respectively) intakes. Furthermore, cardiovascular disease risk was elevated for men and women in the highest quintile of red (HR, 1.27 [95% CI, 1.20-1.35], and HR, 1.50 [95% CI, 1.37-1.65], respectively) and processed meat (HR, 1.09 [95% CI, 1.03-1.15], and HR, 1.38 [95% CI, 1.26-1.51], respectively) intakes. When comparing the highest with the lowest quintile of white meat intake, there was an inverse association for total mortality and cancer mortality, as well as all other deaths for both men and women.

Conclusion: Red and processed meat intakes were associated with modest increases in total mortality, cancer mortality, and cardiovascular disease mortality.

Arch Intern Med. 2009;169(6):562-571

Local / seasonal food

Community gardens

Food Practices

- Shift to more nutritious food
- Reduced meat consumption
- Reliance on local and seasonal food
- Community gardens

Sustainable practices = healthy practices

4. Parks and greenspace

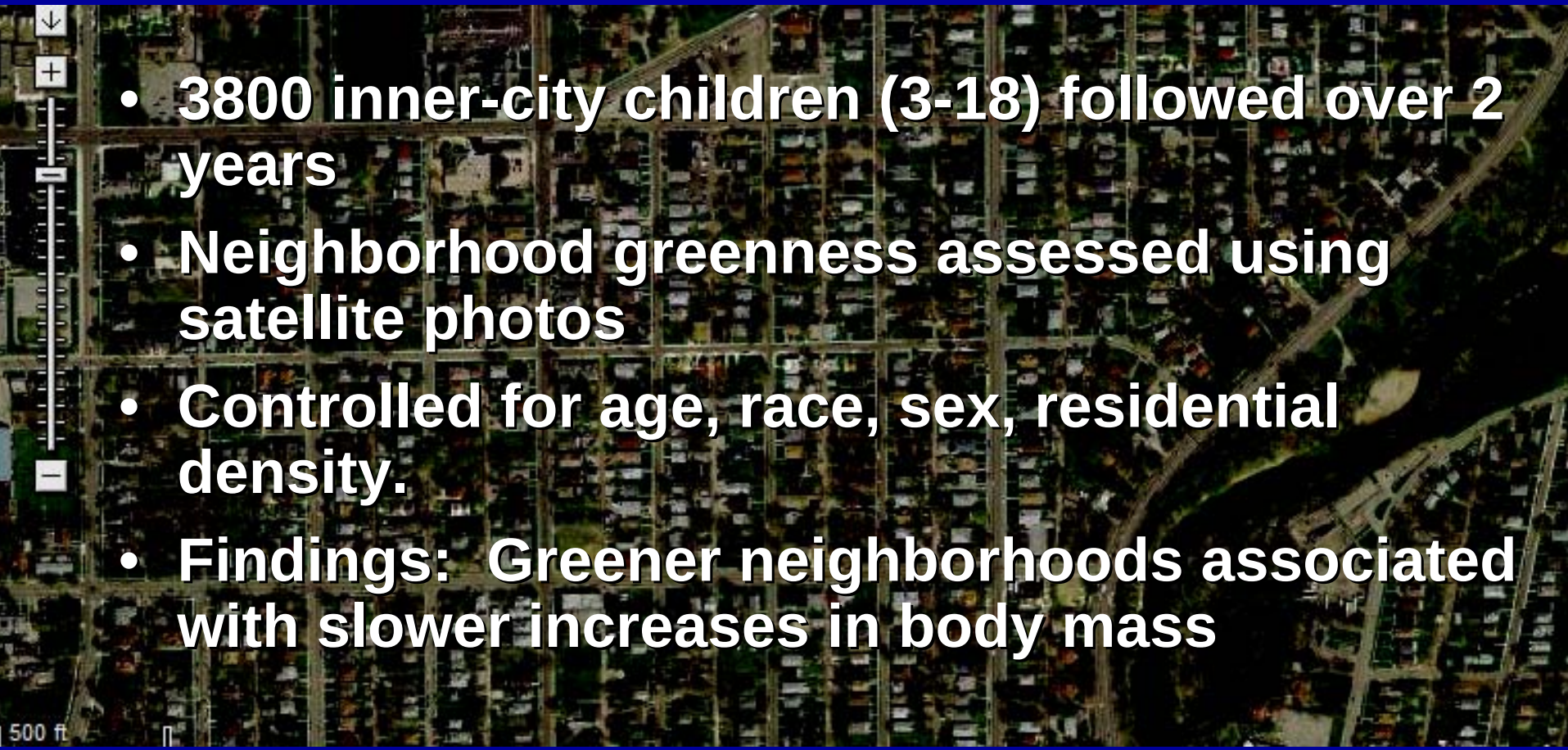
Recreation and social interaction

Park proximity and health

Large urban parks, Copenhagen, summer

- Access to greenspace associated with:
  - Lower level of self-reported stress
  - Lower risk of obesity
- This relationship *not* fully explained by the number of visits to greenspace

Neighborhood greenness and childhood weight gain



- **3800 inner-city children (3-18) followed over 2 years**
- **Neighborhood greenness assessed using satellite photos**
- **Controlled for age, race, sex, residential density.**
- **Findings: Greener neighborhoods associated with slower increases in body mass**

Trees in Cities

- Carbon sequestration
- Cooler temperatures
- Reduced energy demand
- Clean water
- Clean air
- Protection from sunlight
- Venues for physical activity
- Noise reduction
- Mental health
- Spiritual fulfillment

Park and Greenspace Practices

- Increased parkland and greenspace in urban areas
- More trees
- Policies to manage these assets
  - Integration with other public uses
  - Law enforcement
  - Recreational facilities

Sustainable practices = healthy practices

Climate Change: Potential Health Effects

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, hantavirus, encephalitis, Rift Valley fever
WATER-BORNE DISEASES	Cholera, cryptosporidiosis, campylobacter, leptospirosis
WATER AND FOOD SUPPLY	Malnutrition, diarrhea, harmful algal blooms
MENTAL HEALTH	Anxiety, post-traumatic stress, depression, despair
ENVIRONMENTAL REFUGEES	Forced migration, civil conflict

Climate change adaptation

CA.GOV CALIFORNIA CLIMATE CHANGE PORTAL

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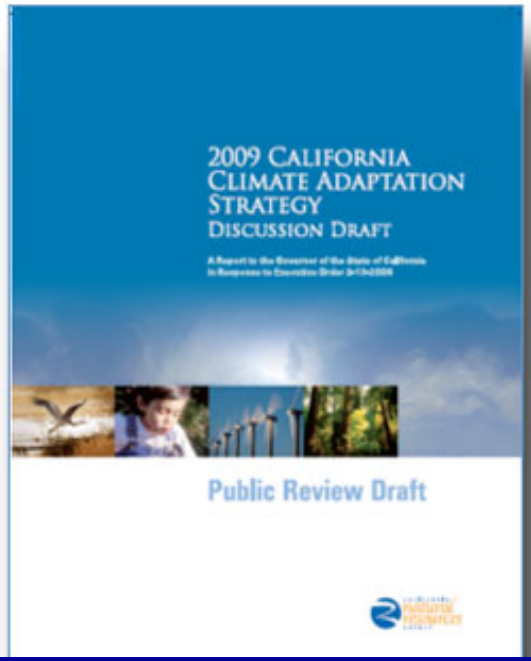
Adaptation, Meetings and Documents

- Adaptation Main Page
- Meetings, Agendas, Documents, and Presentations
- Fact Sheets and Reports

Working Groups

- Biodiversity and Habitat
- Infrastructure (roads, levees, buildings, etc.)
- Oceans and Coastal Resources
- Public Health
- Water
- Working Landscapes (forestry and agriculture)

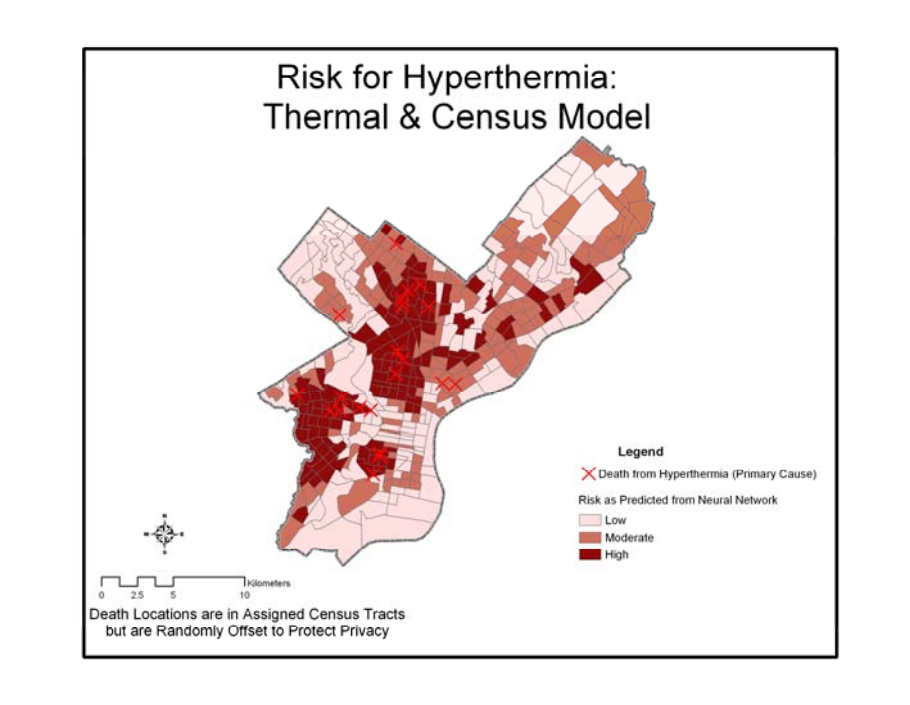
California Climate Adaptation Strategy



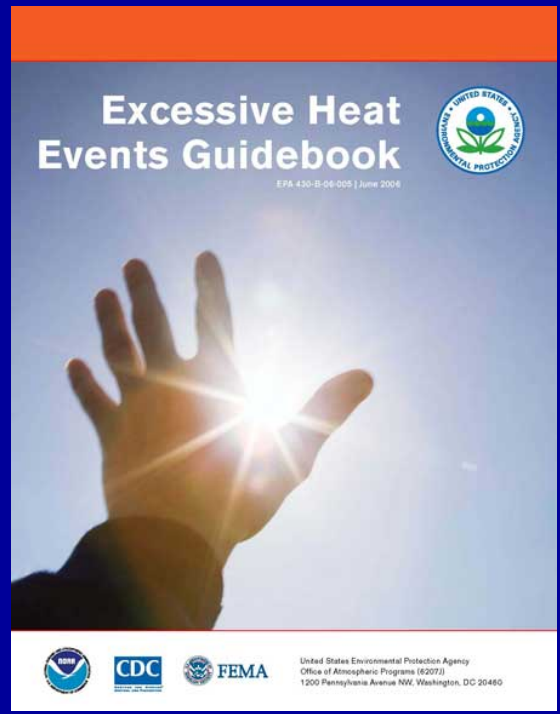
A first-of-its-kind multi-sector strategy to help guide California's efforts in adapting to climate change impacts is now available for public comment. In cooperation and partnership with multiple state agencies, the **2009 California Climate Adaptation Strategy Discussion Draft** summarizes the best known science on climate change impacts in seven specific sectors and provides recommendations on how to manage against those threats. The release of the draft document sets in motion a 45-day public comment period.

Led by the California Natural Resources Agency, numerous other state agencies were involved in the creation of discussion draft, including Environmental Protection; Business, Transportation and Housing; Health and Human Services; and the Department of Agriculture. The discussion draft focuses on sectors that include: Public Health; Biodiversity and Habitat; Ocean and Coastal Resources; Water Management; Agriculture; Forestry; and Transportation and Energy Infrastructure. The strategy is in direct response to Gov. Schwarzenegger's November 2008 Executive Order S-13-08 that specifically asked

Adaptation



Vulnerability Assessment

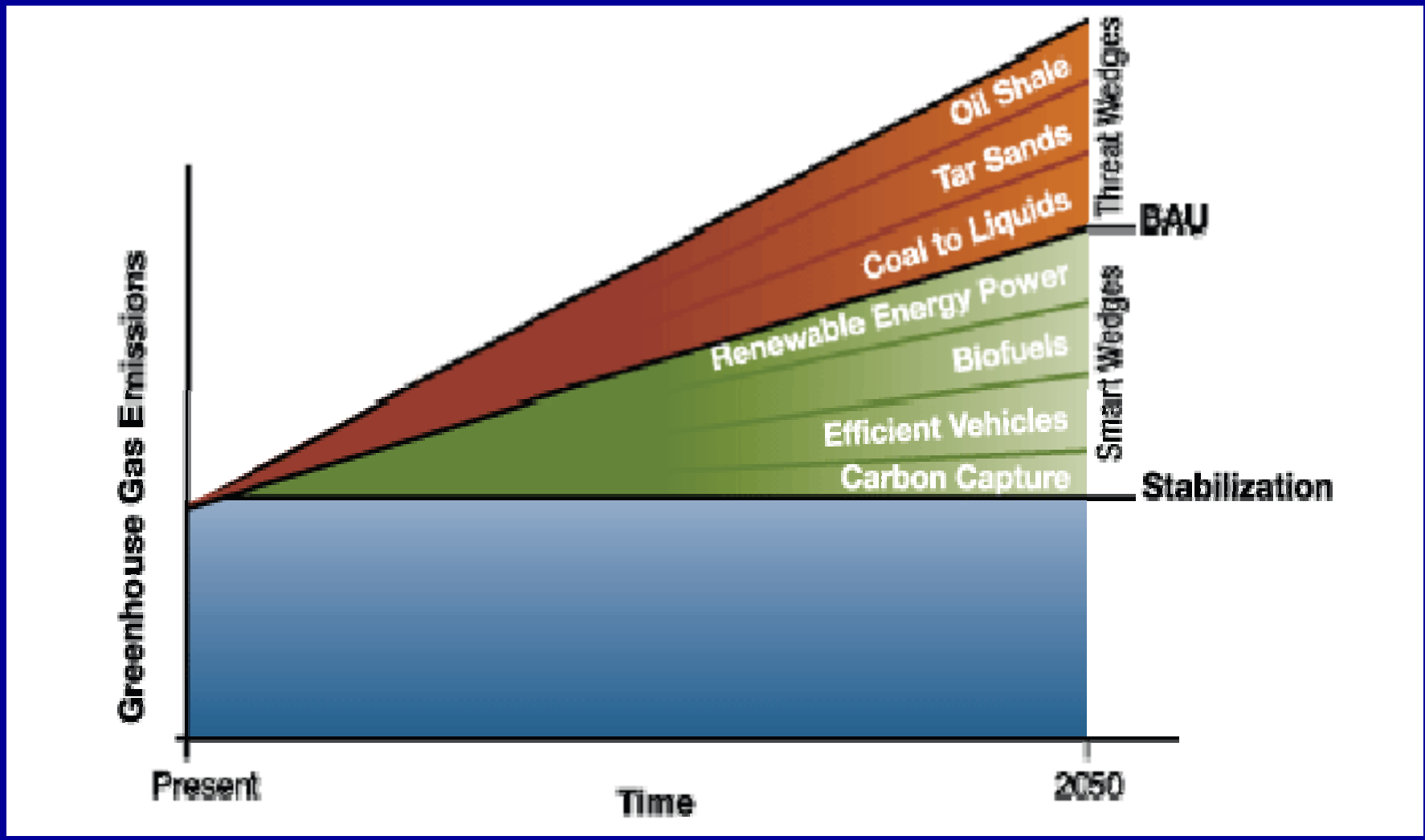


Preparedness

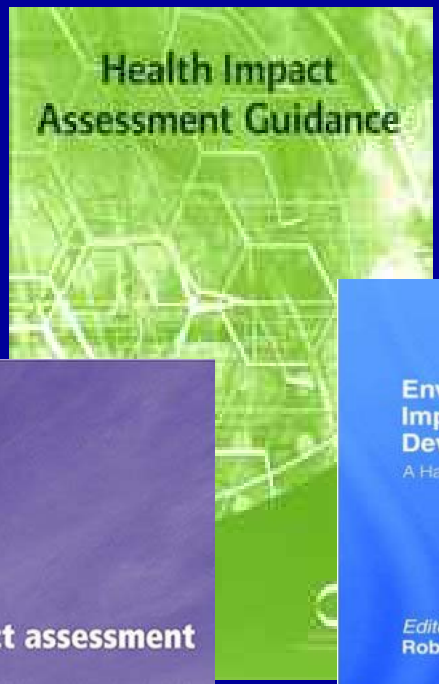
Exercises

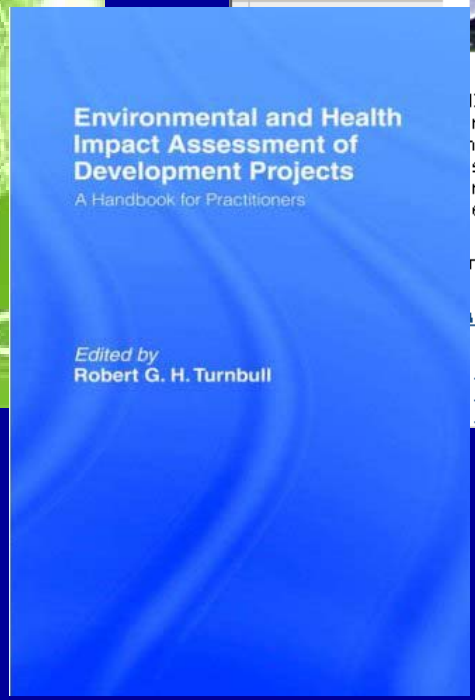
Assessment

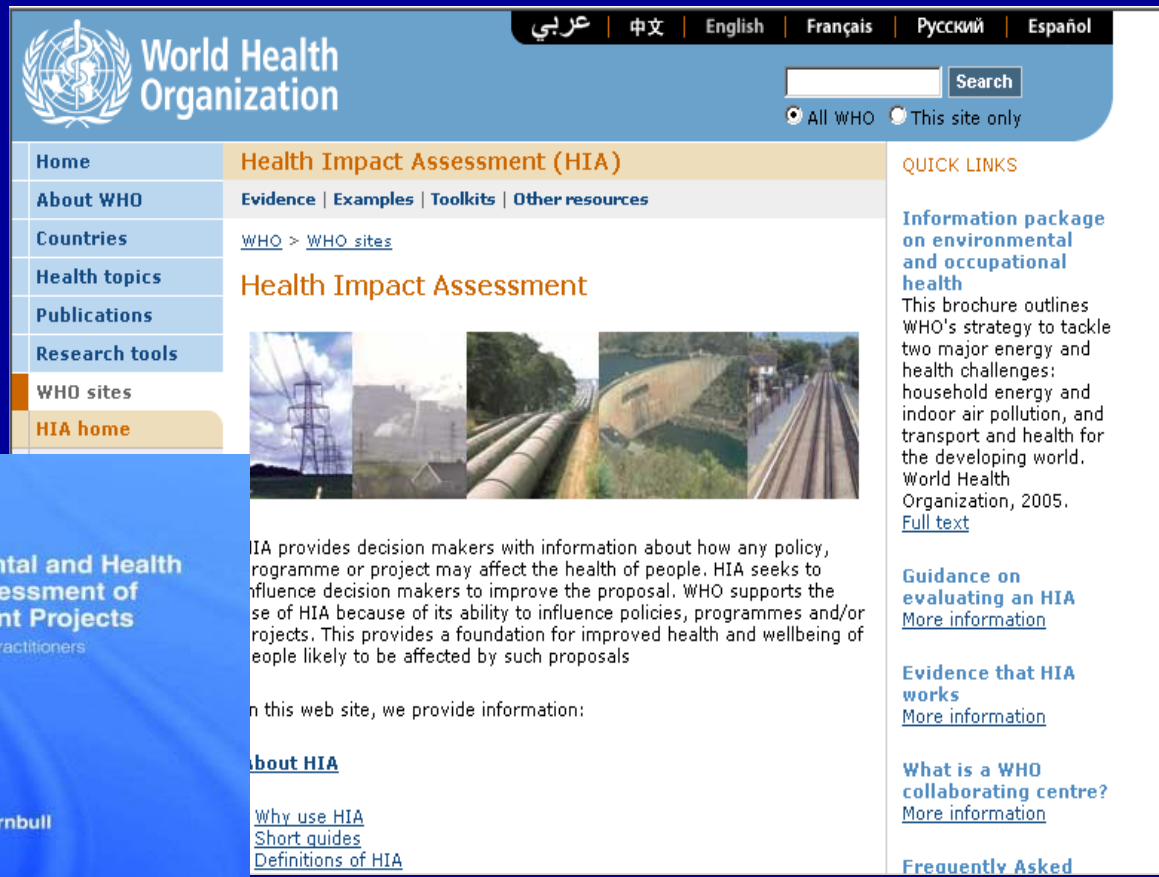
Mitigation


Oil Shale
Tar Sands
Coal to Liquids
Renewable Energy Power
Biofuels
Efficient Vehicles
Carbon Capture
Threat Wedges
Smart Wedges
BAU
Stabilization
Greenhouse Gas Emissions
Present
Time
2050

Health Impact Assessment







Climate Change Practices

- Reduced energy use
- Shift to sustainable energy sources
- Adaptation to climate change
- Mitigation / Health Impact Assessment

Sustainable practices = healthy practices

Urban Sustainability and Health: Synergies in Practice

1. Land use
2. Transportation
3. Food
4. Greenspace
5. Climate change mitigation and adaptation

Health Strategies for Sustainable Cities

- Health sector involvement in sustainability strategies
- Health research on sustainable technologies (including HIA)
- Include health indicators in sustainability indicators
- Social marketing of health as part of sustainability
- Educational efforts that include health

Thank you!