

Changes in residential development styles: large-lot housing



Near Smoky Mountains National Park. Photo: Ed McMahon.

Roots of Sprawl

- Housing policies
- Highway building vs. transit investment
- Zoning policies
- Lack of regional planning
- Competition for tax revenue
- Lifestyle choices



Las Vegas map and total population



1964:	127,000
1972:	273,000
1986:	608,000
1992:	863,000
1997:	1,124,000

Las Vegas, 1972



Las Vegas, 1986



Las Vegas, 1992



Problems with Sprawl

- Environmental impacts
- Health impacts
- Automobile dependency
- Land consumption & loss of farmland
- Loss of a "sense of place"
- Costs to local government (infrastructure)
- Social impacts and disinvestment in city centers

Environmental impacts of low-density land development -- aka Sprawl:

- Water pollution: reduction in water quality through creation of impervious surfaces
- * Air pollution: On-road vehicles impact on urban health and add greenhouse gases
- * Soil erosion
- * Habitat loss and fragmentation: loss of local biodiversity
- * Loss of farmland
- * Inefficient resource use: and depletion of non-renewable resources (e.g. petroleum); increased energy consumption

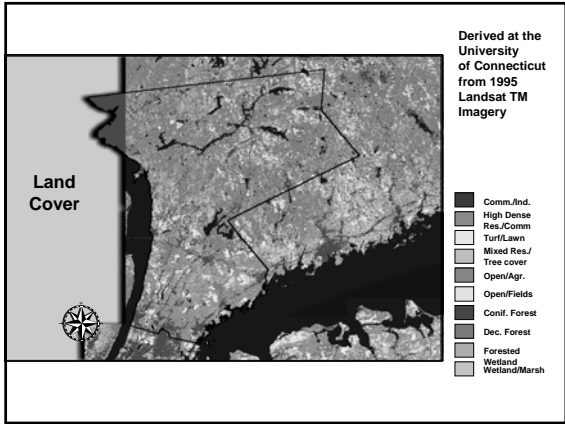
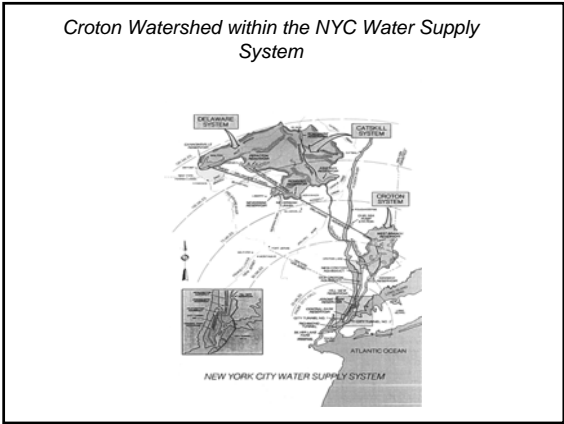
Urbanization impacts on aquatic resources in four categories:

- * Hydrology
- * Geomorphology
- * Water quality
- * Habitat

What is a Watershed?

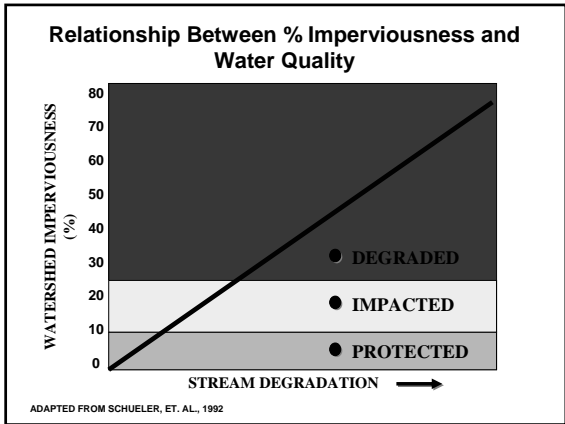
A watershed is a geographic area of land that drains waters to a shared destination. Watershed is a drainage basin that divides the landscape into hydrologically defined areas.





Impervious surfaces

- Indicate intensive land uses that cause pollution
- Inhibit recharge of groundwater
- Prevent natural processing of pollutants in soil, plants
- Provide a surface for accumulation of pollutants
- Provide an express route for pollutants to waterways

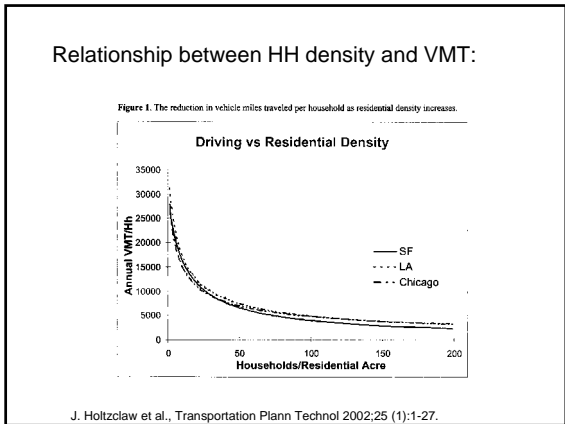


Air Quality

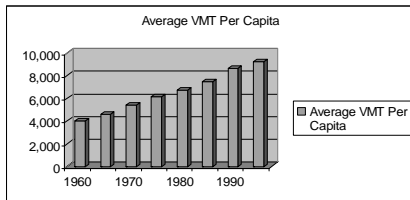
Rank	Metro Area	Total Number of Days of Unhealthy Air Quality (2000 to 2002)
1	Riverside-San Bernardino, CA	445
2	Fresno, CA	421
3	Bakersfield, CA	409
4	Los Angeles- Long Beach, CA	255
5	Sacramento, CA	163
6	Pittsburgh, PA	134
7	Knoxville, TN	109
8	Birmingham, AL	100
9	Houston, TX	94
10	Baltimore, MD	93

Source: Surface Transportation Policy Project, 2003

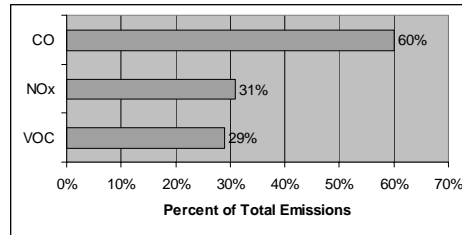
- Although improvements since the 1970 Clean Air Act, number of "unhealthy" days increasing for many metropolitan areas, especially in regards to ozone.



Vehicle Miles Traveled (VMT) Per Capita, 1960-1995



Contribution of Highway Vehicles to Total U.S. Emissions of CO, NOx, and VOC, 1996



Source: Bureau of Transportation Statistics, U.S. DOT, 1998.

Air Quality Impacts

Rank	Metro Area	Percent of all Criteria Pollutants from Transportation (1999)
1	Fort Worth-Arlington, TX PMSA	60.2%
2	San Antonio, TX MSA	57.1%
3	Los Angeles-Long Beach, CA PMSA	56.9%
4	Austin-San Marcos, TX MSA	56.7%
5	Dallas, TX PMSA	56.4%
6	Hartford, CT MSA	55.6%
7	New York, NY PMSA	53.9%
8	Seattle-Bellevue-Everett, WA PMSA	53.6%
9	Columbus, OH MSA	53.4%
10	Denver, CO PMSA	52.7%

Source: Surface Transportation Policy Project, 2003

Vehicle emissions also include CO₂, fine particulate matter, and other toxic air pollutants, and are associated with increased risk of premature mortality, asthma, cancer and heart disease.

Pedestrian Safety

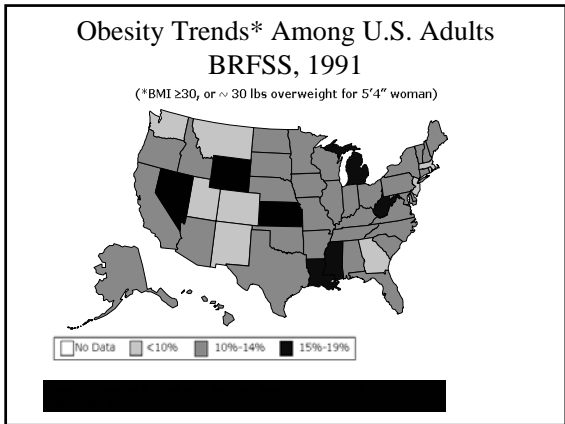
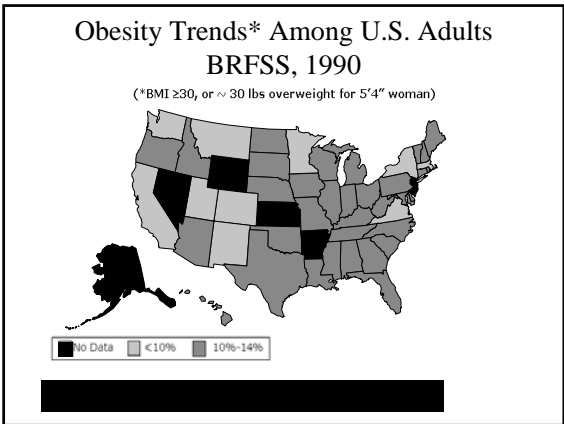
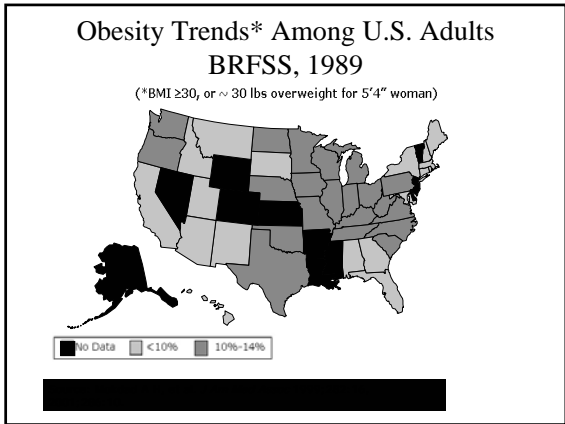
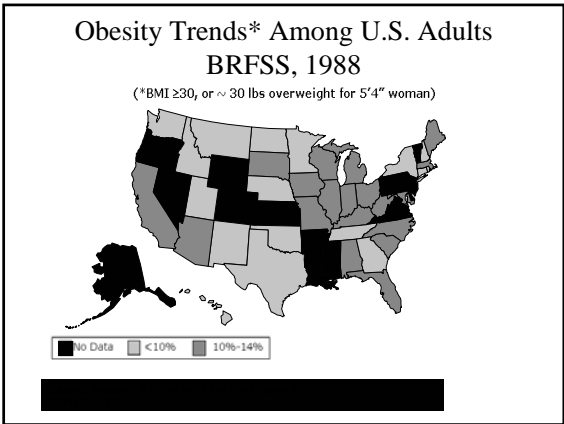
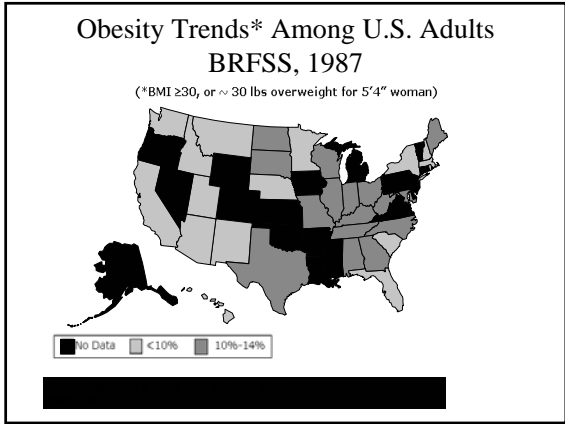
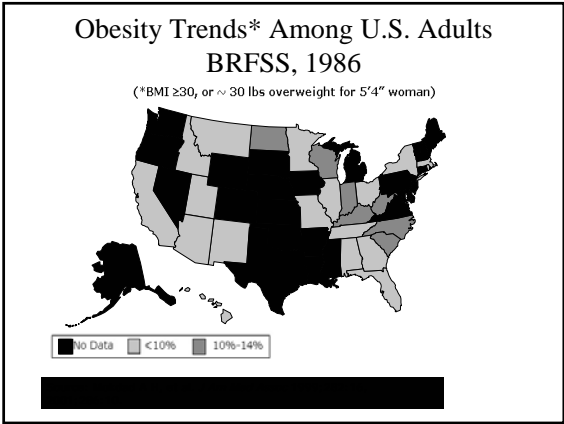


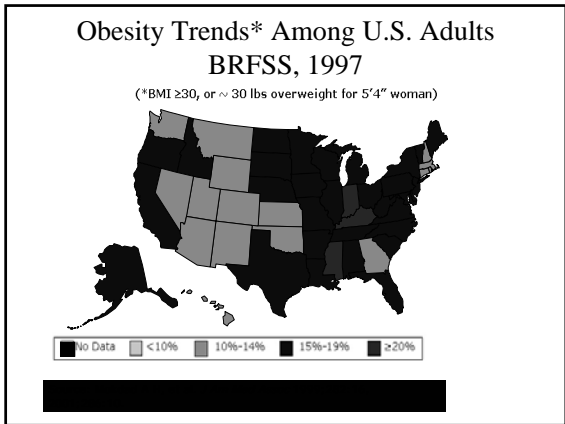
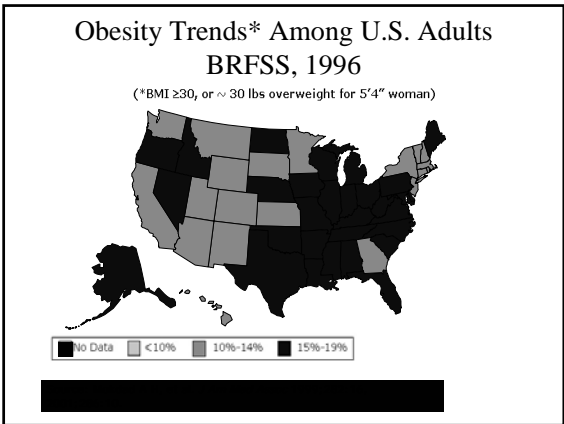
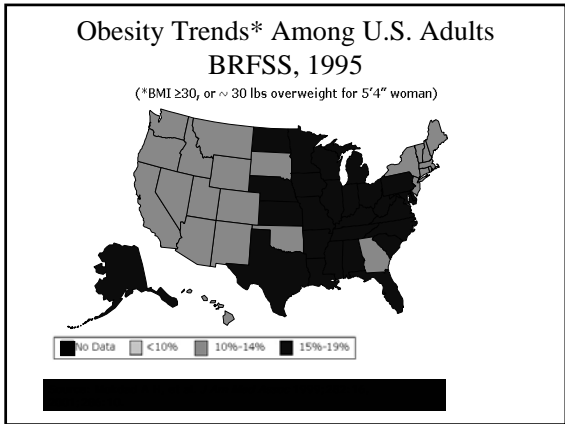
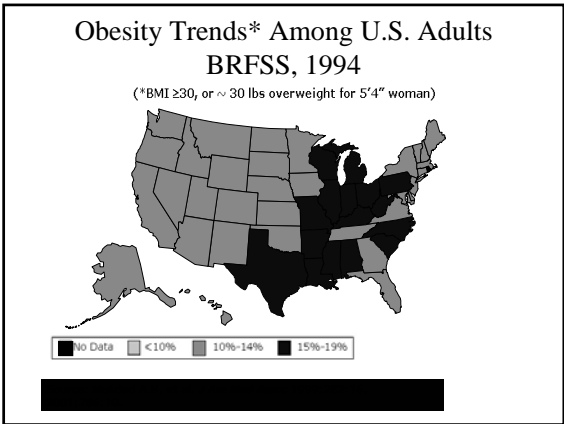
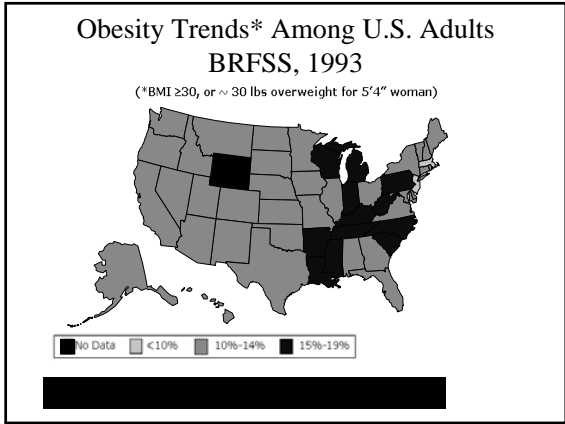
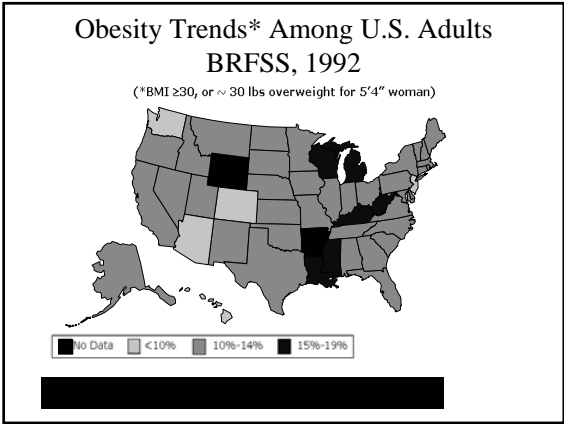
In the US, it's estimated that each year, automobiles cause about 5,000 – 6,000 fatalities and 80,000 – 120,000 injuries among pedestrians nationwide.

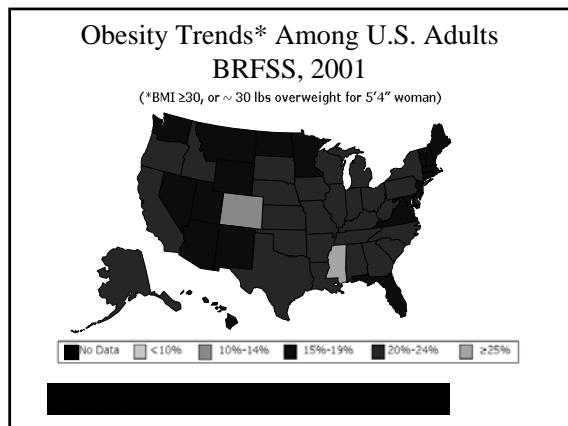
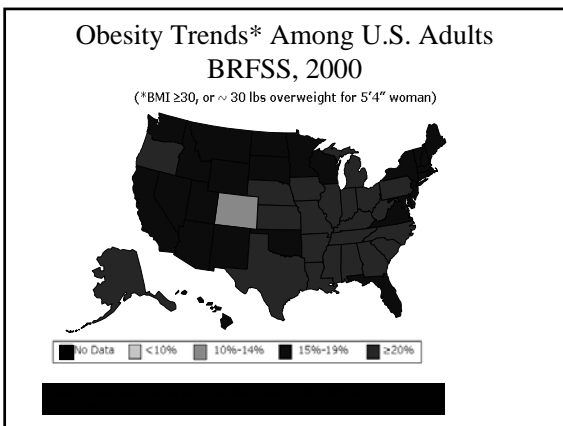
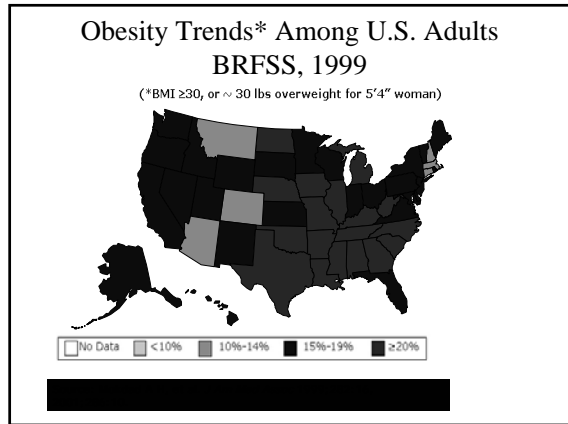
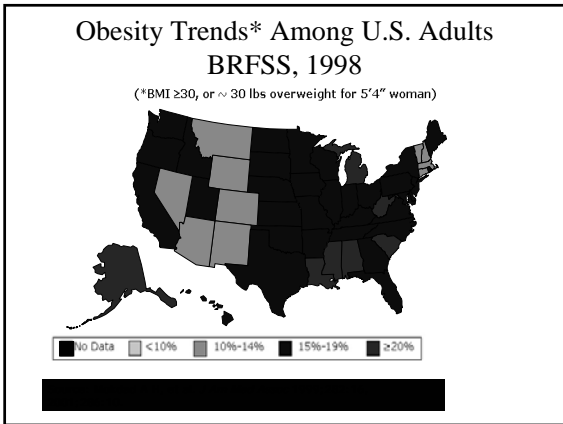
Urban form and physical activity

- Urban form affects the relative convenience and viability of walking or biking for recreational, shopping, or work purposes – and thus influences the levels of physical activity patterns.
- Only 30-40% of the American population engages in regular sustained exercise – another 30% are completely inactive!
- Car dependency is associated with reduced walking or bicycling.









Overweight

- 2.5-fold risk of overall mortality*
- 4-fold risk of cardiovascular mortality*
- 5-fold risk of diabetes
- Risk of hypertension, gall bladder disease, and some cancers

(*30-44 age group, less at older ages)

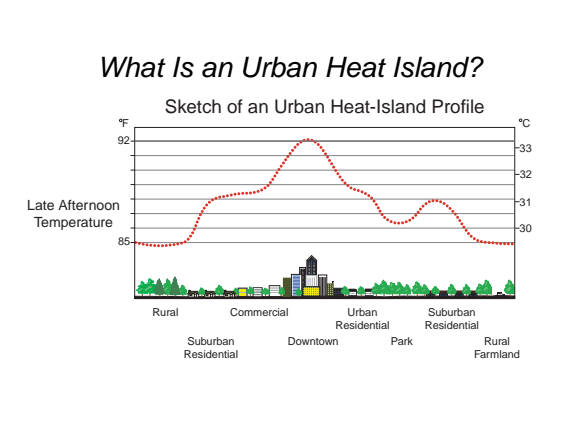
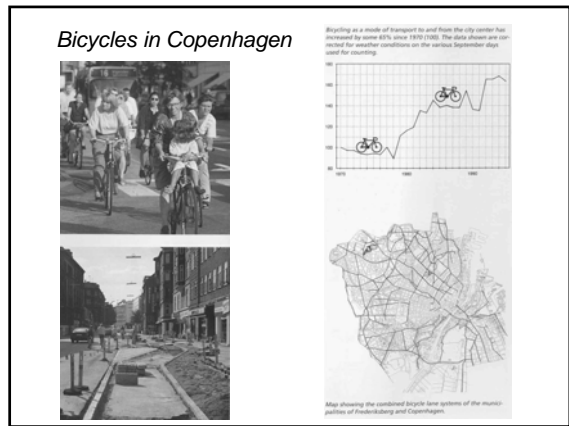
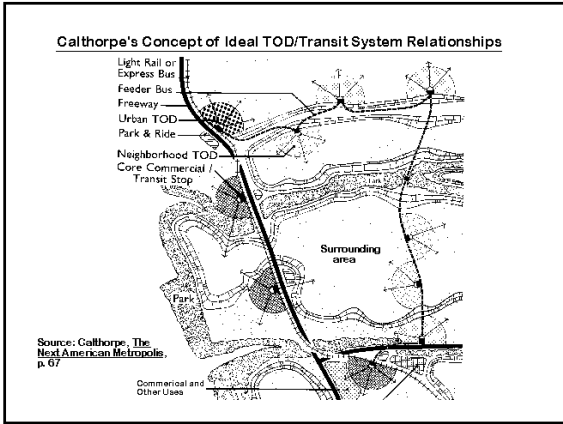
Source: Willet et al., *New Eng J Med*, 1999

PEDESTRIAN POCKET

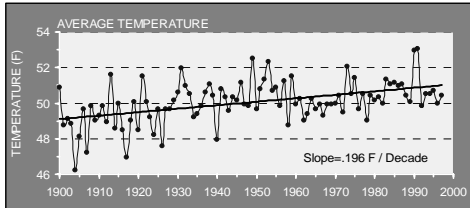
The "pedestrian pocket – a balanced, mixed-use area within a 5 minute walking radius of a transit station.

Functions within this zone include housing, offices, retail, day care, recreation and parks."

These pockets support light rail systems that are pedestrian-friendly.



NY Regional Temperature Trends



Note: 23-station average for 31-county region, corrected for urban heat island effect.
Graph from NASA-GISS, MEC/NYCHP Team

Heat Waves in the News:

•Summer heat wave in France:

•Over 14,000 excess deaths in August 2003

•Continuing worldwide media coverage of global climate change

Heat-Related Mortality: as Public Health Issue

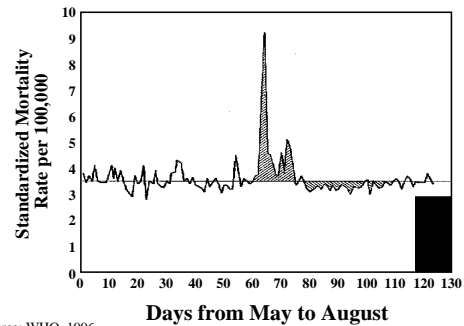
* Direct heat casualties (NOAA)

- 1936-1975: 20,000 US deaths
- #1 US weather killer in 1995, 1998, 1999, 2000
- current US average ~220/yr

* Heat-related casualties (health researchers)

- NYC: 307/aver summer now, 460-1000 by 2050 with climate change (Kalkstein & Greene, 1997)

Deaths Associated with the July 1966 Heat Wave, New York City

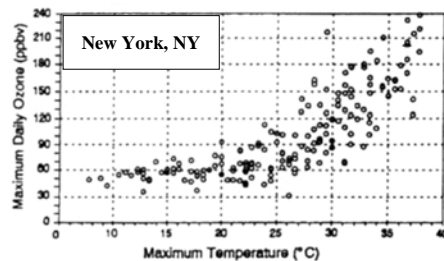


Source: WHO, 1996

Relevant Risk Factors for Heat-Related Mortality

- Elderly most susceptible to heat stress
- Built-environment and social factors: A/C access, isolation
- Early season heat waves worst

Maximum Daily Ozone Concentrations and Maximum Daily Temperature



Cool City Project: NYC Urban Heat Island Mitigation & Research



A Columbia University interdisciplinary initiative:
SPH, GSAPP, CIESIN

Mitigation Measures: Light-Colored Surfaces and Trees

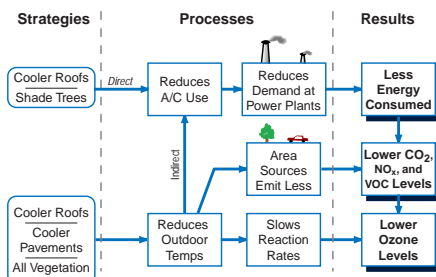
Direct Effect

- Light-colored or vegetated roofs reflect solar radiation, reduce air-conditioning use
- Trees that shade buildings reduce air-conditioning use

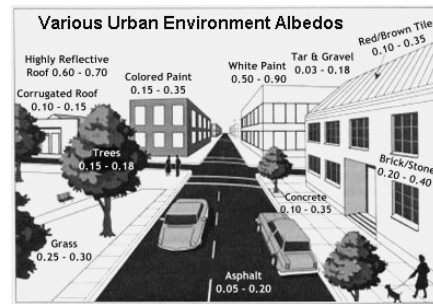
Indirect Effect

- Light-colored surfaces in a neighborhood alter surface energy balance; result in lower ambient temperature
- Vegetation in a neighborhood reduces ambient temperature by **evapotranspiration**

Methodology: Energy and Air-Quality Analysis



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Albedo measures the fraction of incident solar energy reflected by surfaces. Low albedo means that larger amounts of solar energy are absorbed, and higher surface temperatures result.

Reflective Pavements are Cooler

☞ Fresh asphalt
Albedo: 0.05
Temperature: 123°F

☞ Aged asphalt
Albedo: 0.15
Temperature: 115°F

☞ Prototype asphalt coating
Albedo: 0.51
Temperature: 88°F



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TO HELP SENIORS SURVIVE SUMMER HEAT

Qualifying seniors receive FREE:

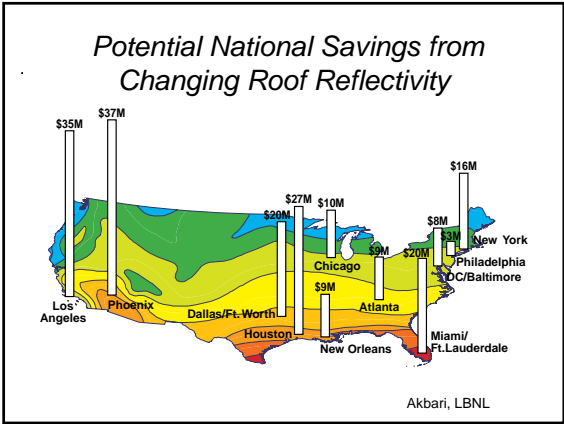
- 1) New white roof coat to reflect the hot sun
- 2) Roof insulation
- 3) Window repair, fans and more

Do you know anyone who:

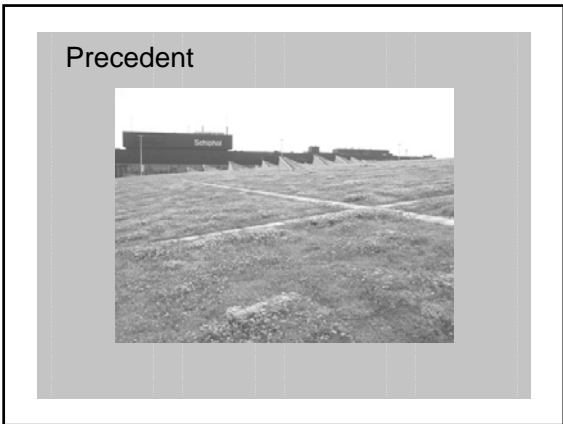
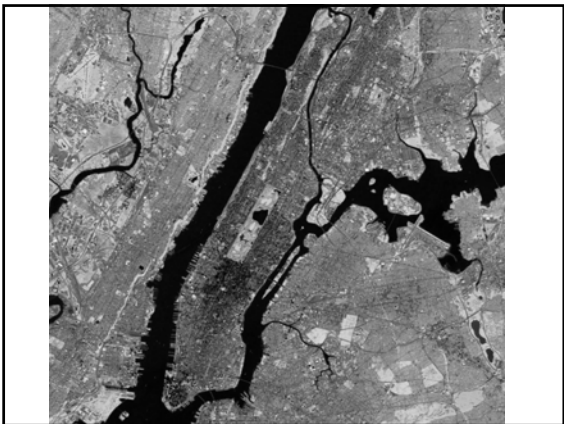
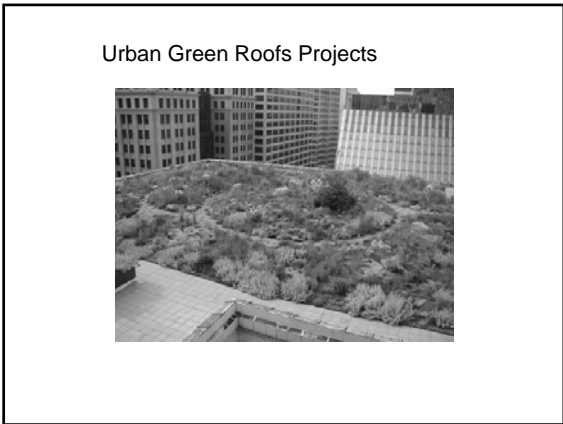
- 1) Is over 65 years old
- 2) Owns their own home
- 3) Lives alone and may be isolated
- 4) Has an annual income no more than \$12,885 (150% of federal guidelines)
- 5) Lives in South Philly (19145,46,47,48) or West Philly (19104,31,39,43,51)
- 6) Lives in a 2 story row house

ECA crew applying reflective white roof coat.

From the Philadelphia Energy Coordinating Agency



- ### Objectives of A Cool City Project
- *Phase 1: Research on design and feasibility of residential roof-top demonstration projects;* demographic analysis and identification of "hot" neighborhoods through thermal imagery; selection of methods for test projects
 - *Phase 2: Implementation and documentation;* measurement of energy consumption in demonstration buildings; preliminary assessment of air quality and public health impacts of UHI mitigation
 - *Phase 3: Analysis of results and community outreach;* Including an economic impact assessment of energy savings and benefits of cool roofing techniques, on an individual building and the community scale.



Using Living Roofs to Emulate Natural Processes



Long Island City



Habitat and Biodiversity Loss: The Sixth Extinction



As the human population and land development increases, more and more habitats are impacted. Today, we may be losing 30,000 species a year -- a rate much "faster than at any time since the last great extinction 65 million years ago that wiped out most of the dinosaurs. Estimated rate is 1,000 - 10,000 times above normal "background level."

American Museum of Natural History

Native New Yorkers: Some endangered local species

Animals including the otter, mink, wolves, water shrews, bobolinks, meadowlarks, bog turtles, mole salamanders.

Plants including the northern wild Monkshood; Swamp pink; Seabeach Amaranth, Houghton's Goldenrod, eastern Prairie fringed Orchid, American hart's-tongue Fern, etc.



Courtesy: Jeffrey Larkin, US Geological Survey

Goals? Research to understand the interactions between land-use and public health priorities, and "smart growth" rather than sprawl:

Beneficial characteristics include:

- Compact development
- Reduced impervious surfaces and water detention
- Safeguarding ecologically sensitive areas
- Mixed land uses
- Transit accessibility
- Urban design: support for pedestrian & bicycle activity