

Dimensions of Remote Sensing for Environmental and Public Health

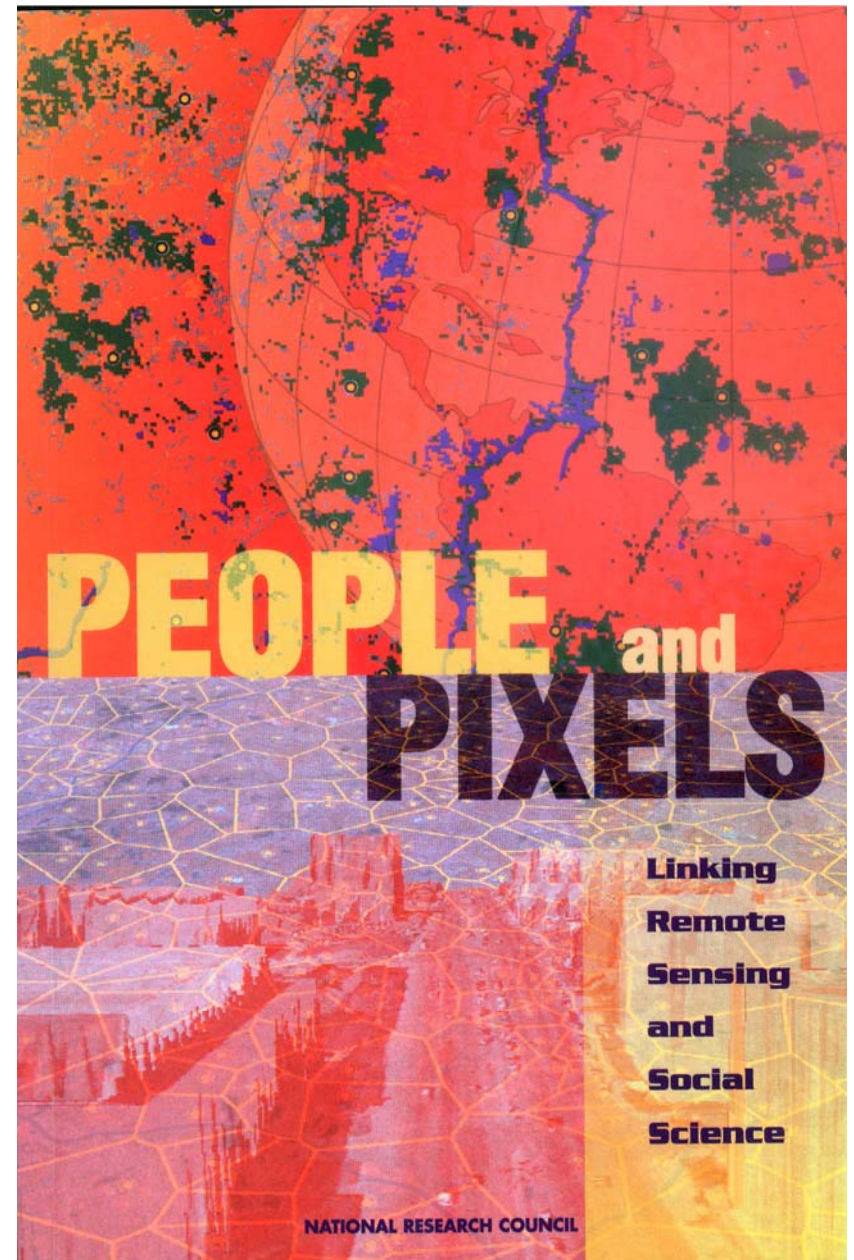
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31st ISRSE
St. Petersburg, Russia
June 21, 2005
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Topic Outline

- Socializing the pixel
- Hazards, Disasters, and Health
- Emerging diseases and increasing aerosols
- Dust and mortality
- Sustainable development strategies
- Simulating epidemics: roles for satellite observations and geospatial analysis

Remote Sensing and GIS for People

“Human beings are at the center of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature.”



Johannesburg Plan of Implementation

¶-54:

- Integrate health issues into strategies, policies, and programs for sustainable development;
- Provide technical and financial assistance for health information systems and integrated databases;
- Target research and apply research results to priority public health issues and reduce public health risks;
- Start international initiatives to assess health and environment linkages; and,
- Develop programs to prevent, promote, and cure chronic respiratory diseases.

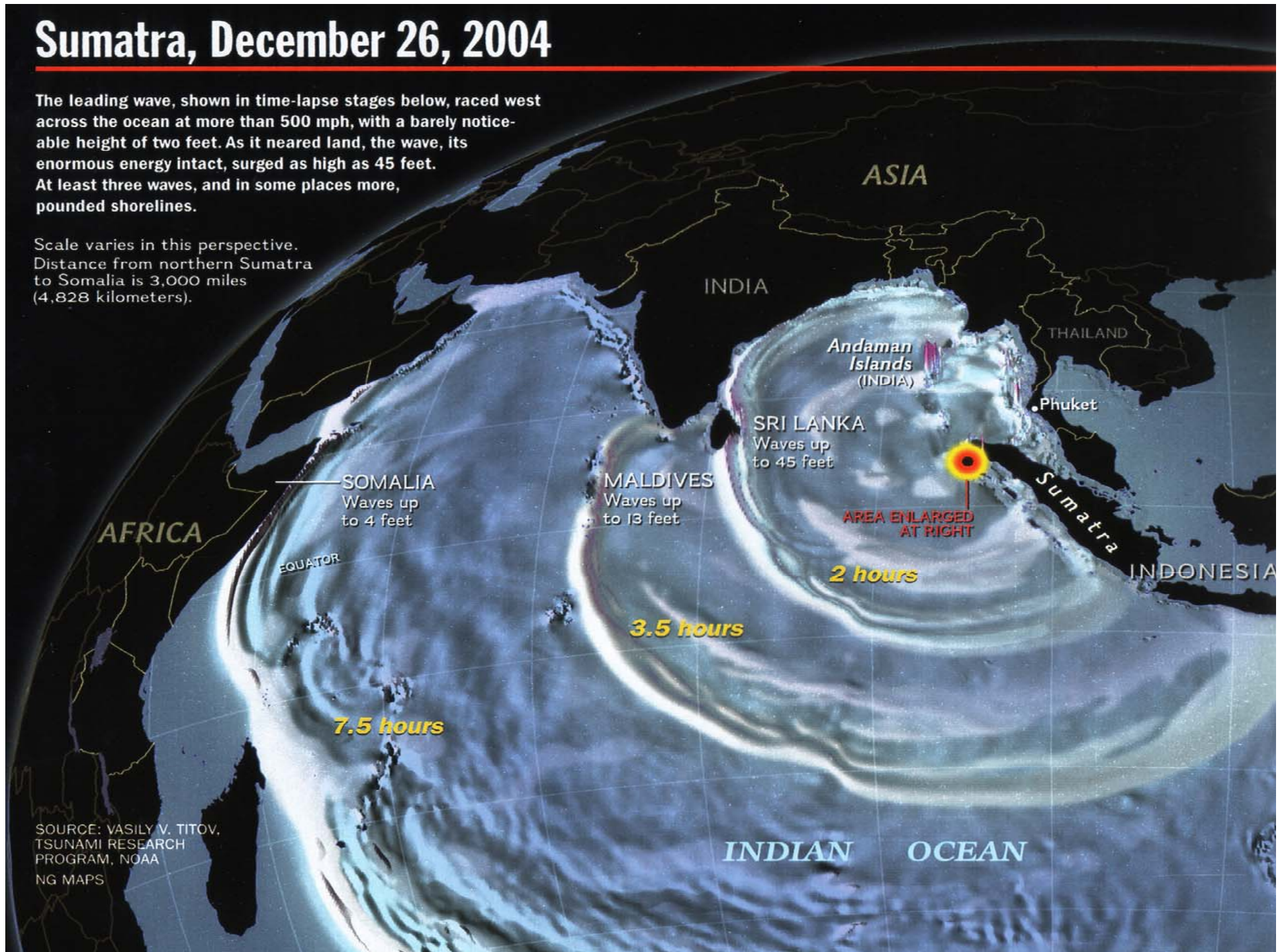
¶ 56:

- Reduce respiratory diseases and other health impacts resulting from air pollution;

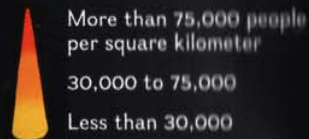
Sumatra, December 26, 2004

The leading wave, shown in time-lapse stages below, raced west across the ocean at more than 500 mph, with a barely noticeable height of two feet. As it neared land, the wave, its enormous energy intact, surged as high as 45 feet. At least three waves, and in some places more, pounded shorelines.

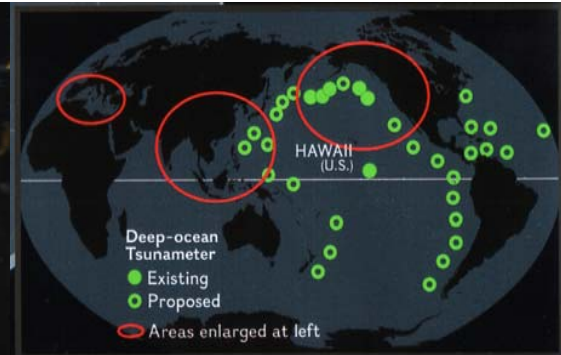
Scale varies in this perspective.
Distance from northern Sumatra to Somalia is 3,000 miles (4,828 kilometers).



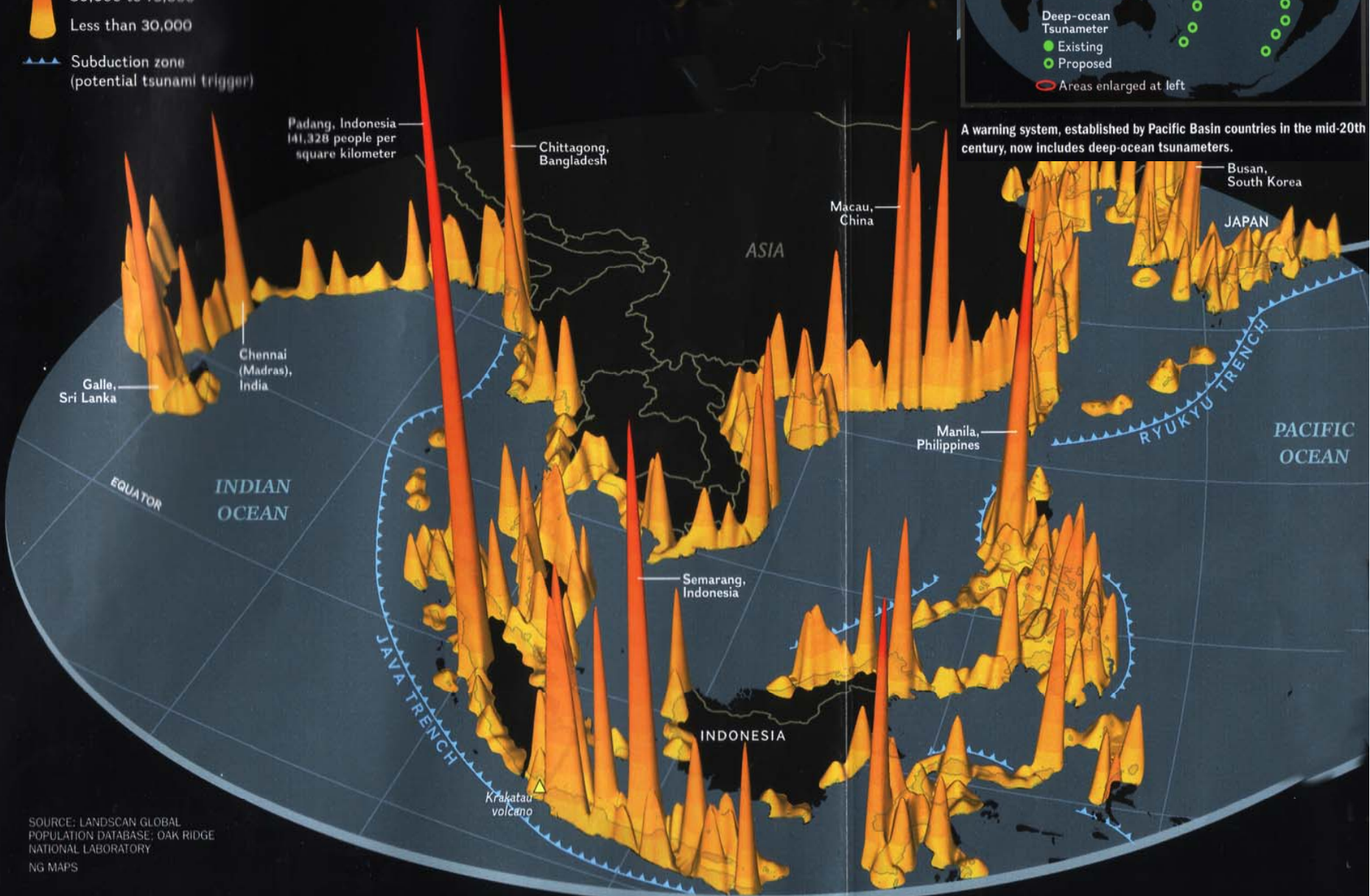
Population density within 2 kilometers (1.2 miles) of coastline in areas less than 10 meters (33 feet) in elevation



Subduction zone (potential tsunami trigger)



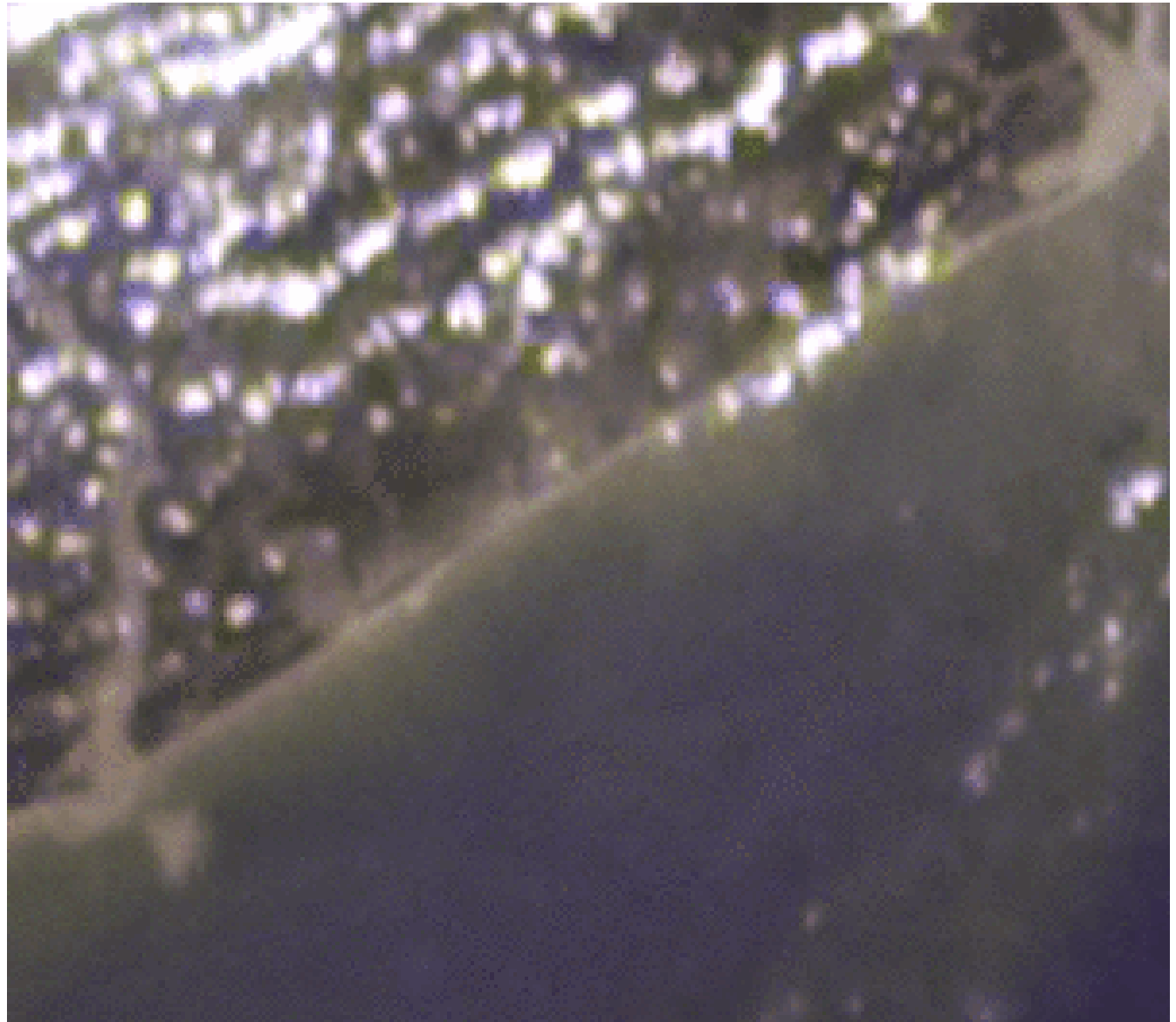
A warning system, established by Pacific Basin countries in the mid-20th century, now includes deep-ocean tsunameters.



SOURCE: LANDSCAN GLOBAL POPULATION DATABASE; OAK RIDGE NATIONAL LABORATORY; NG MAPS

Tsunami Comes Ashore

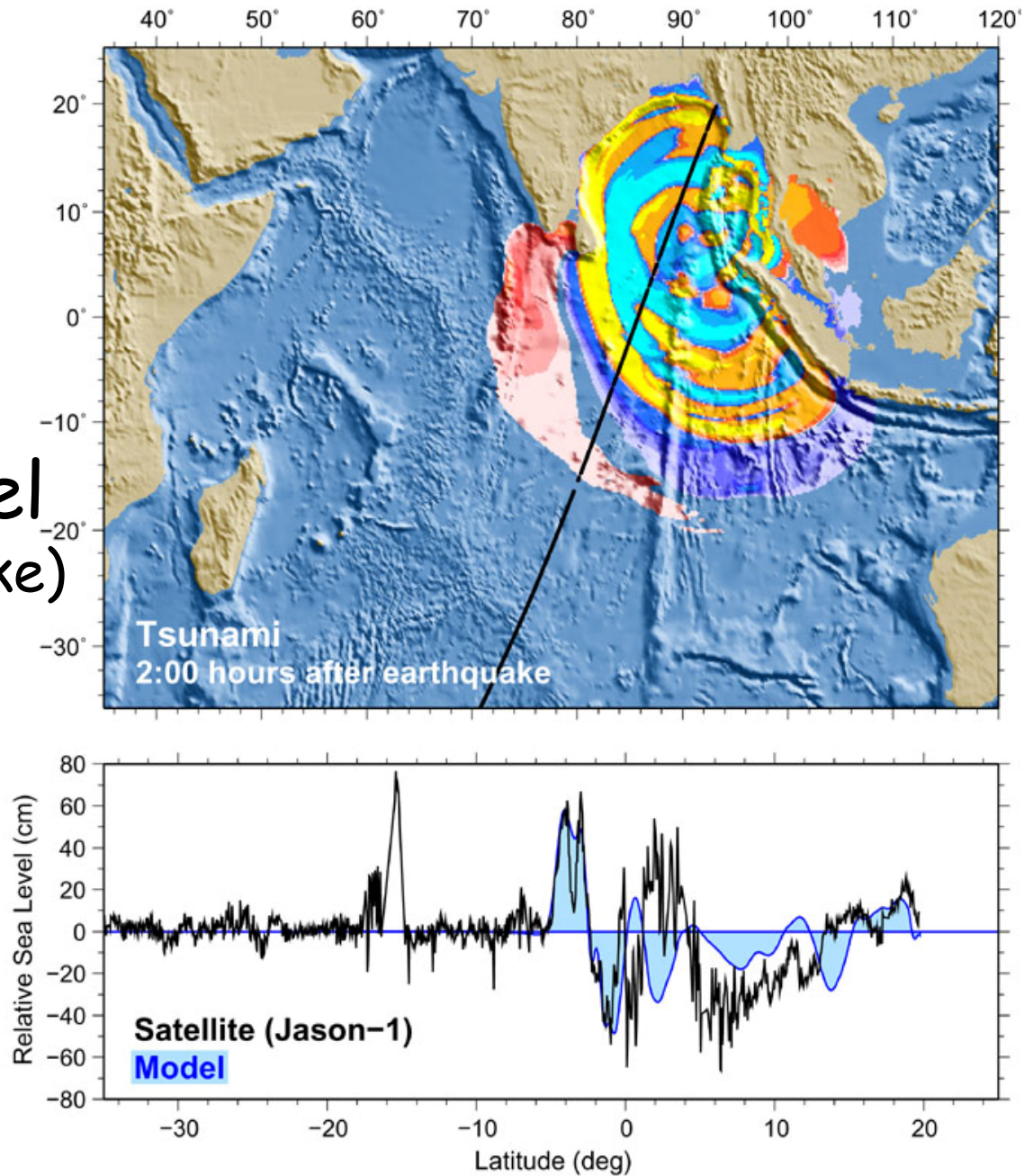
MISR animation
(8 scenes)



Courtesy, NASA

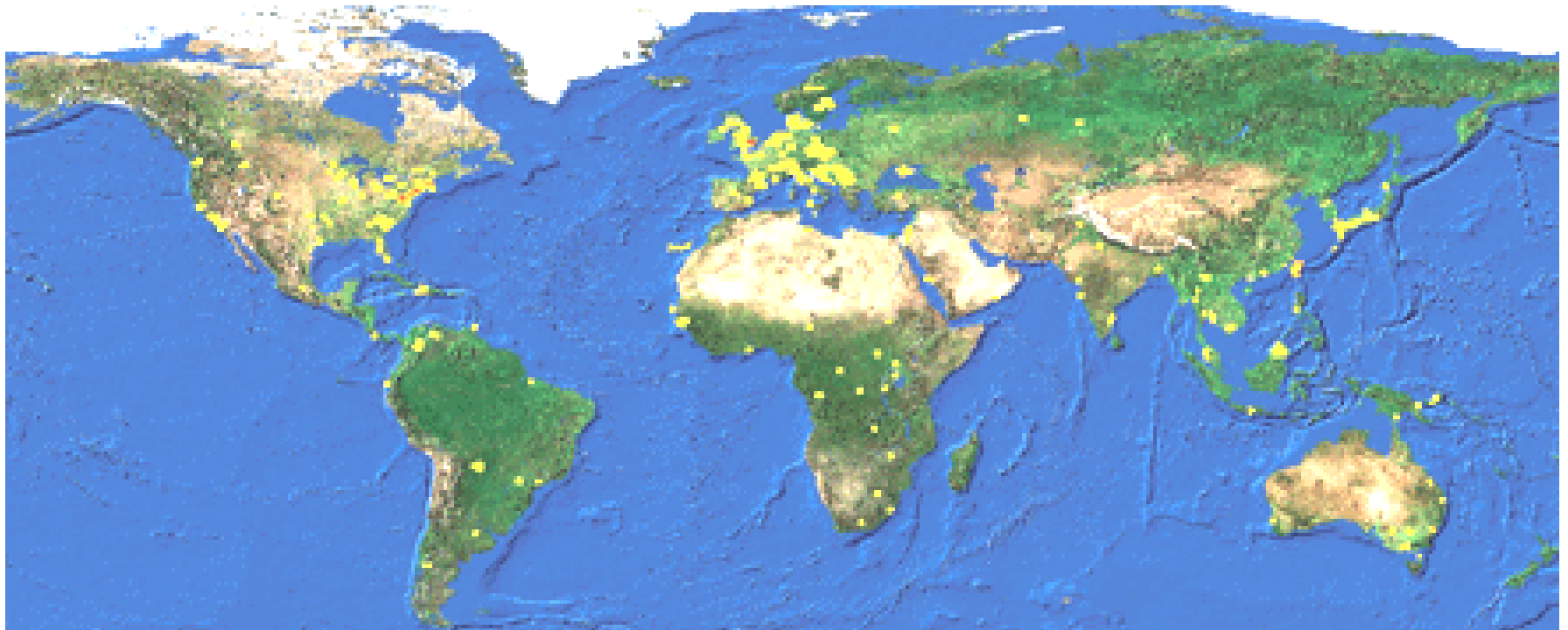
Tsunami Relative Sea Level (2 hrs. after earthquake)

Blue line = Modeled
Black line = Jason-1



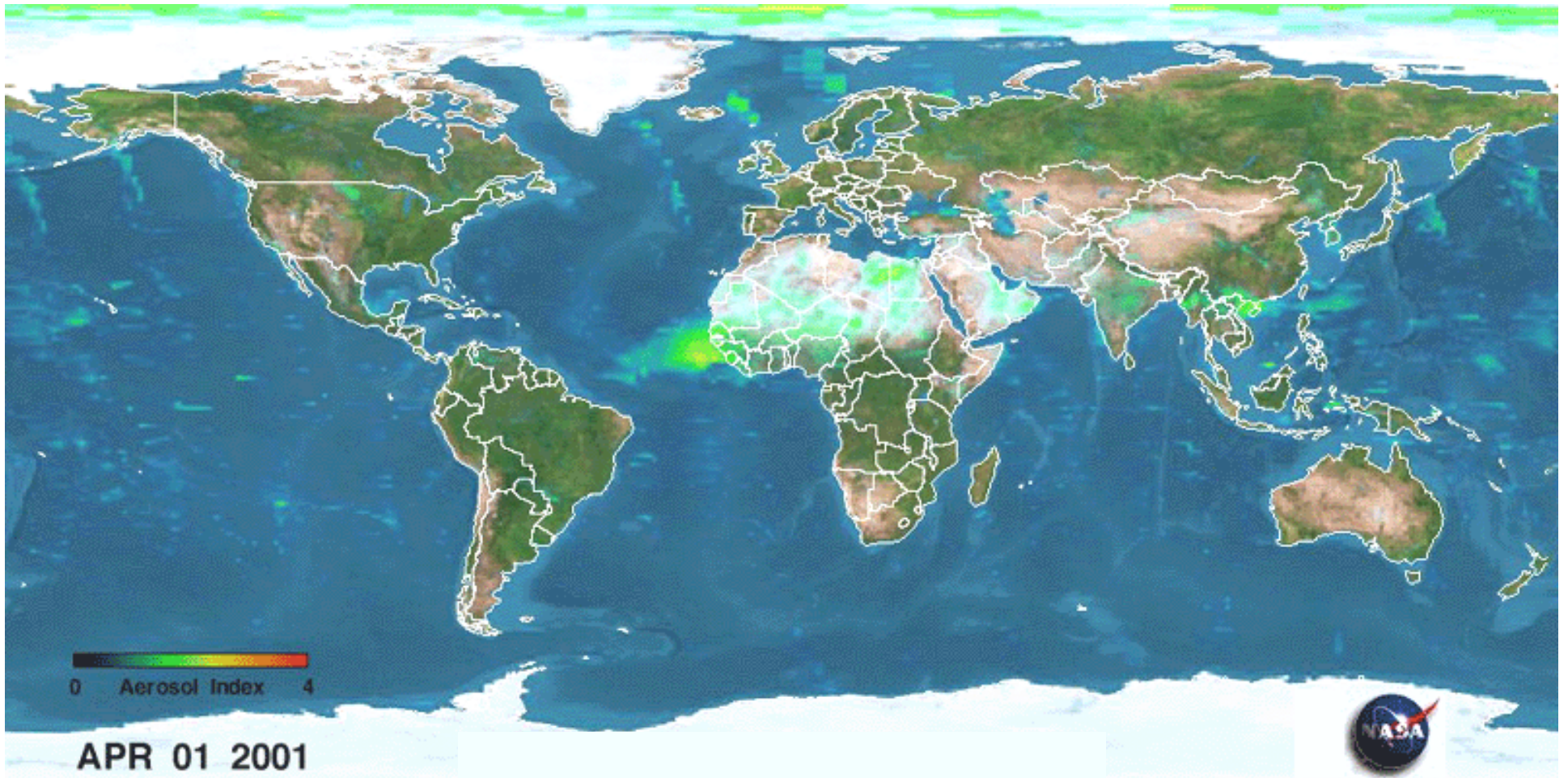
Courtesy, NASA

Locations of Emerging Infectious Diseases

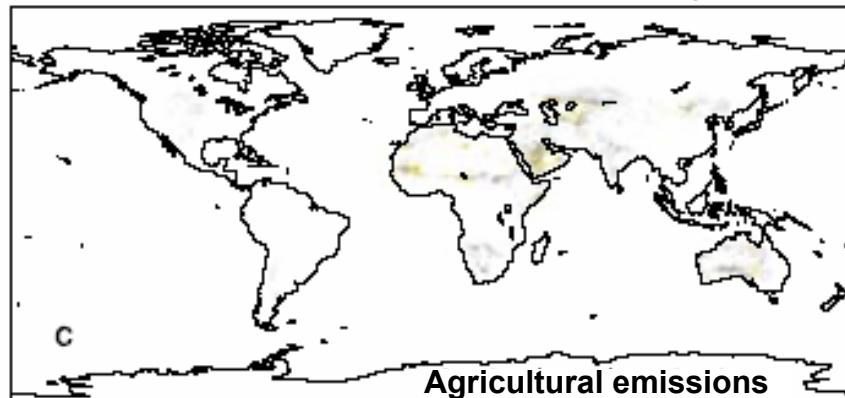
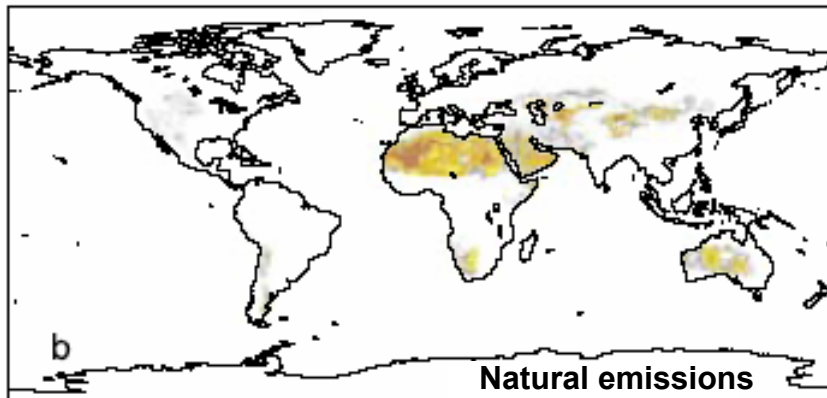
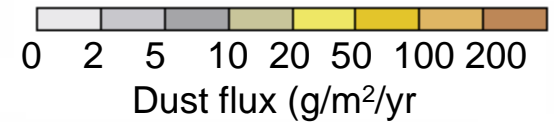
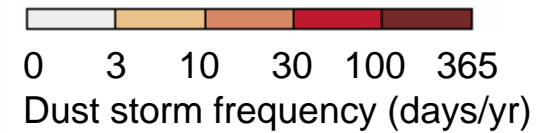
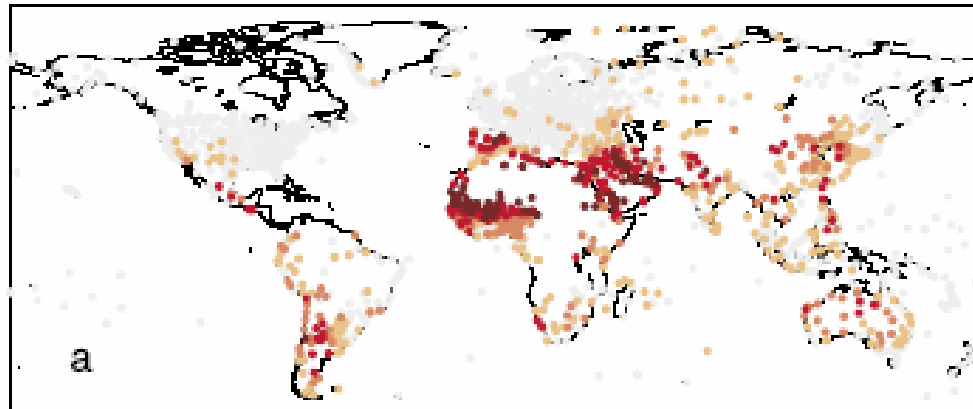


Source: U.S. Centers for Disease Control, 2005

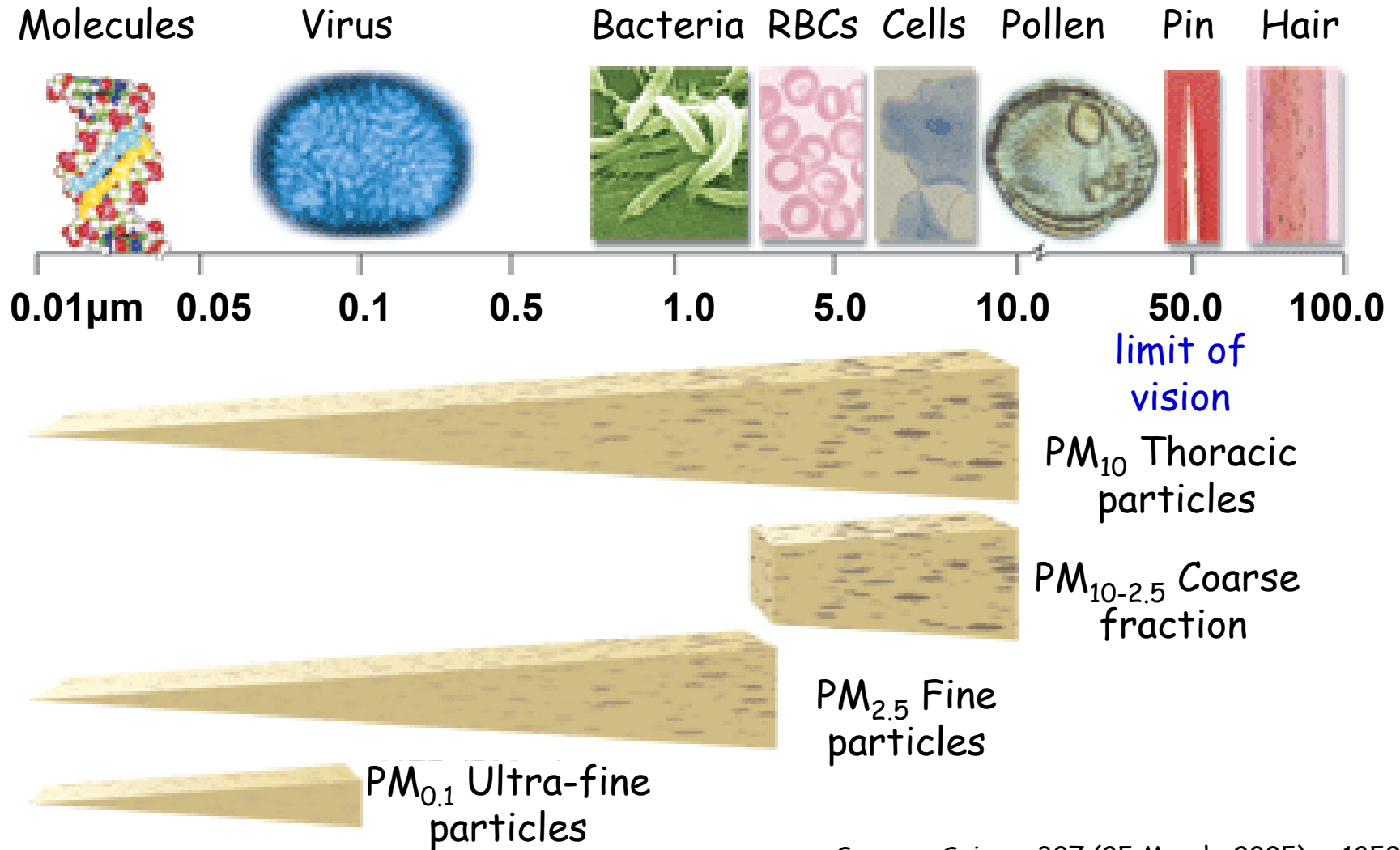
Temporal Visualization of Aerosols



Dust Storm Frequency And Estimated Emissions 1963-1992 (averaged)

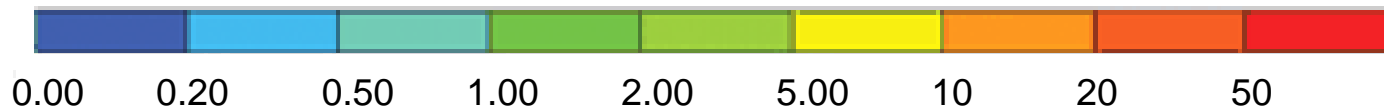
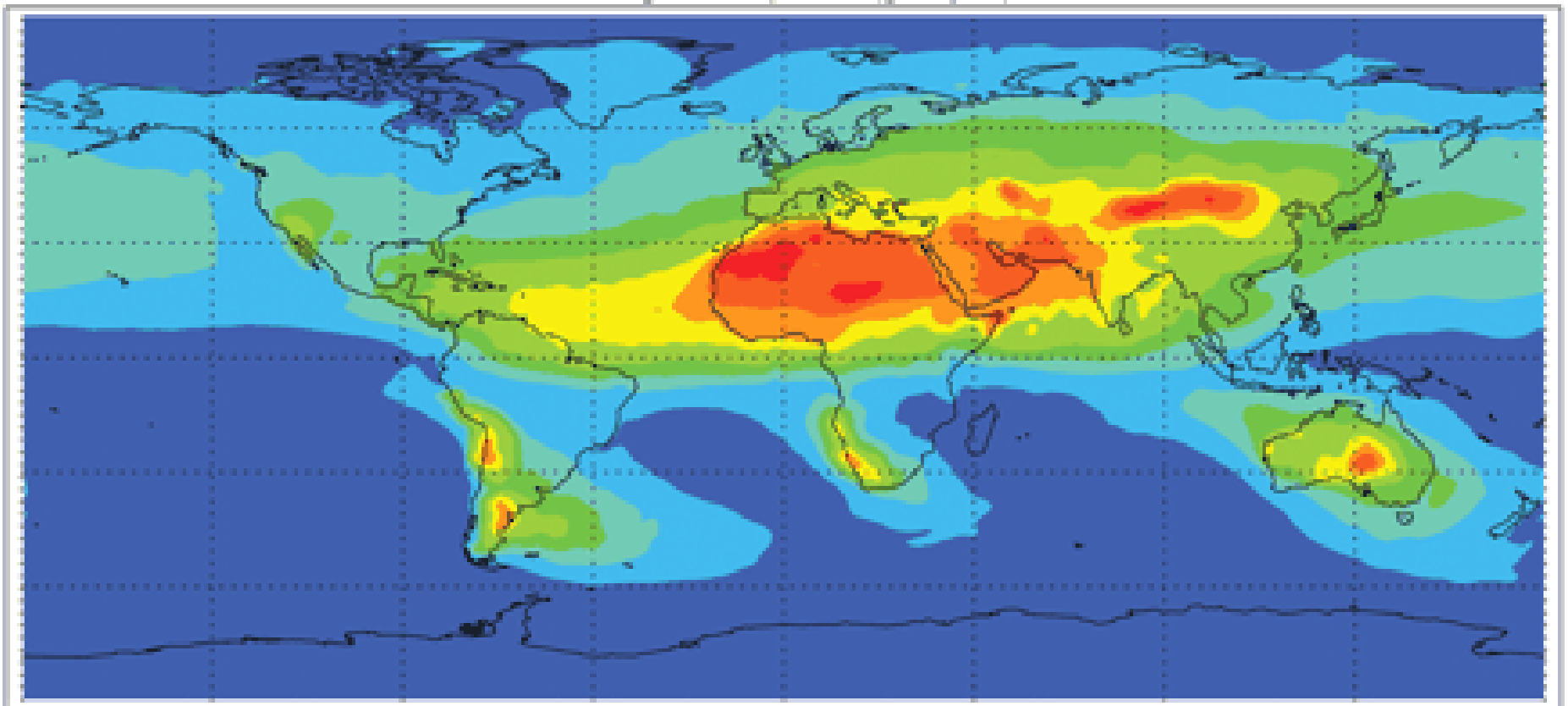


Particulate Matter Size Distribution & Their Related Biophysical Impacts



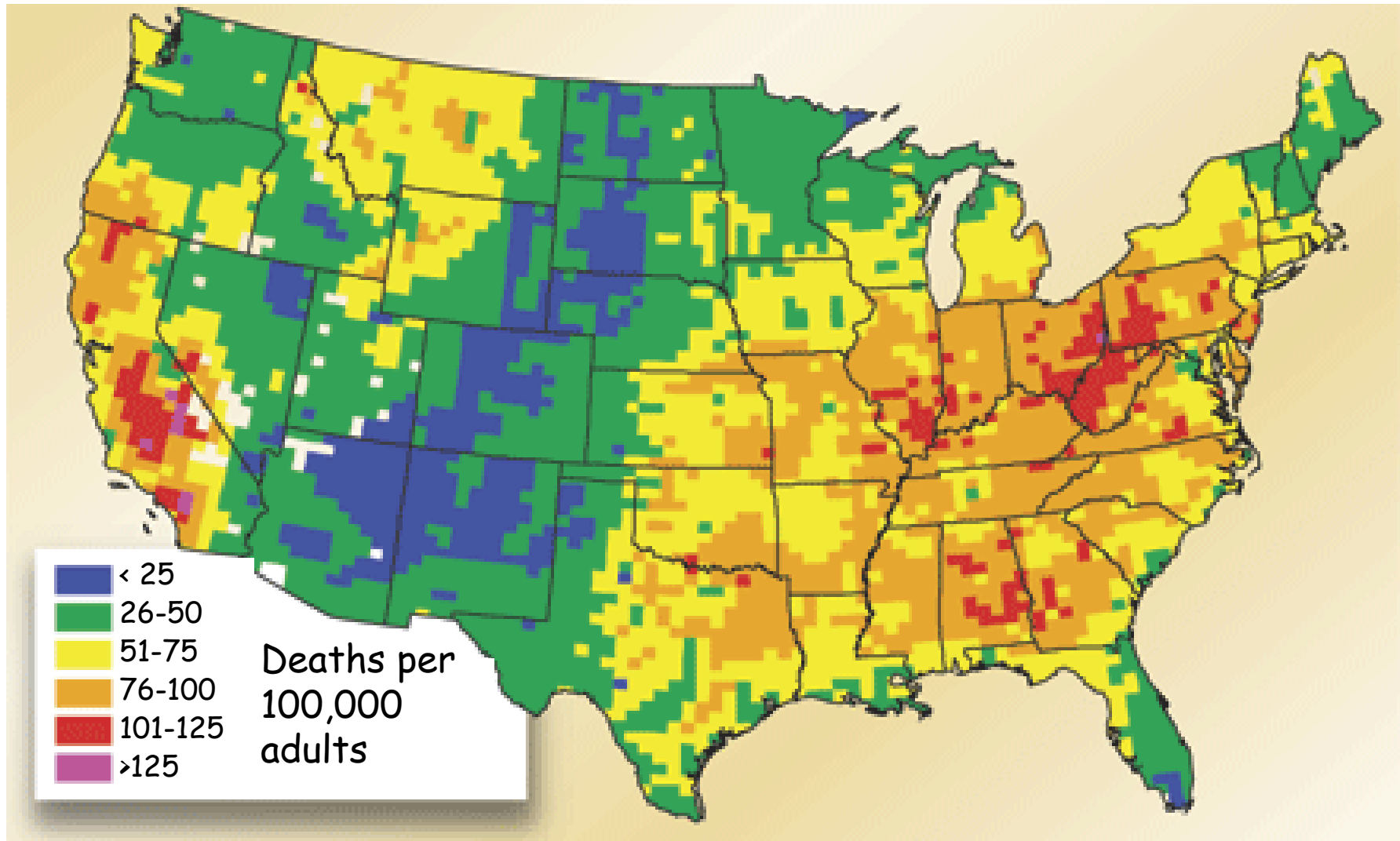
Source: *Science* 307 (25 March, 2005), p.1859

Average Dust Deposition ($\text{g}/\text{m}^2/\text{year}$)



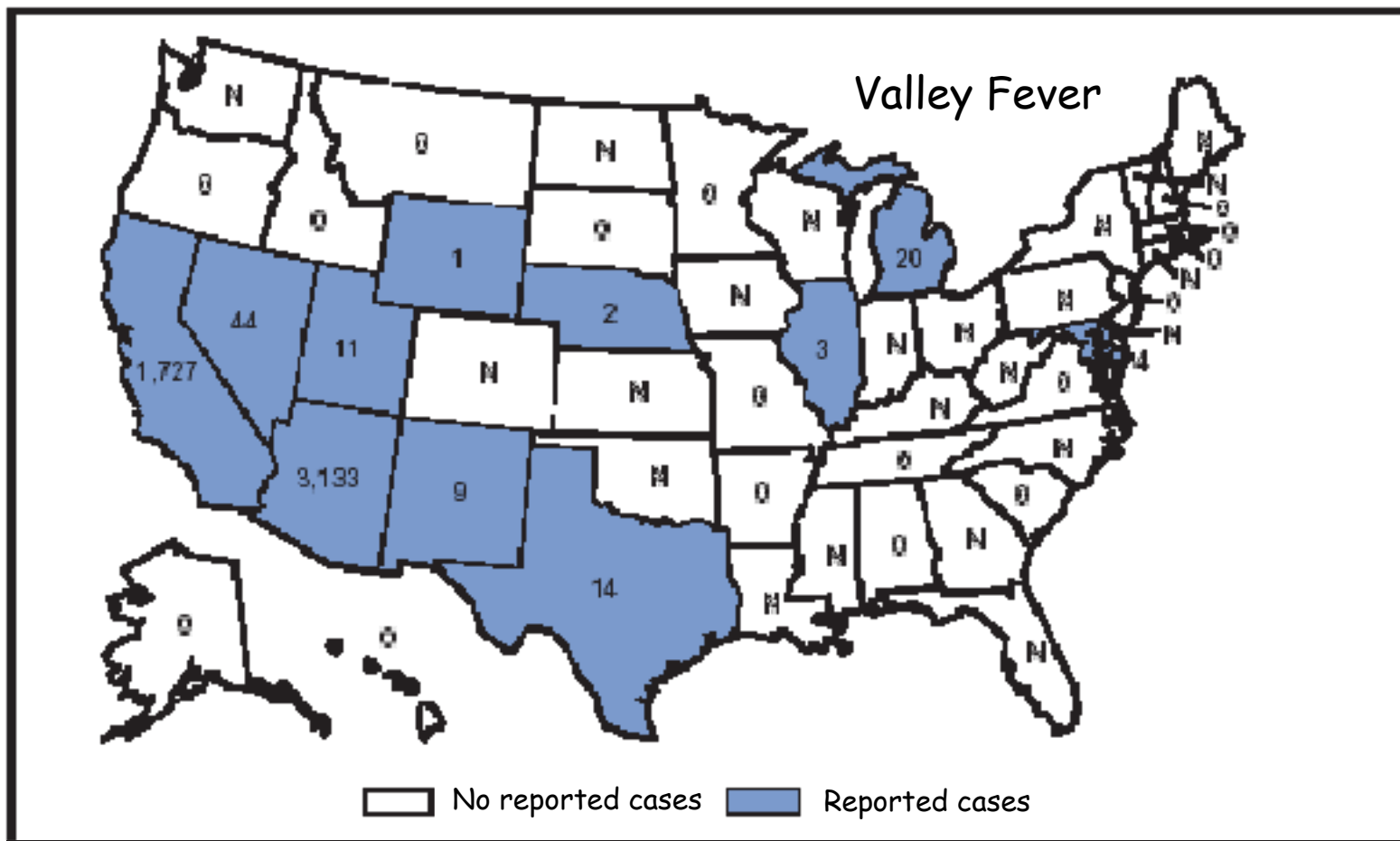
Source: *Science* 308 (1 April, 2005) p.70

Premature Mortality Risk Attributable to $PM_{2.5}$

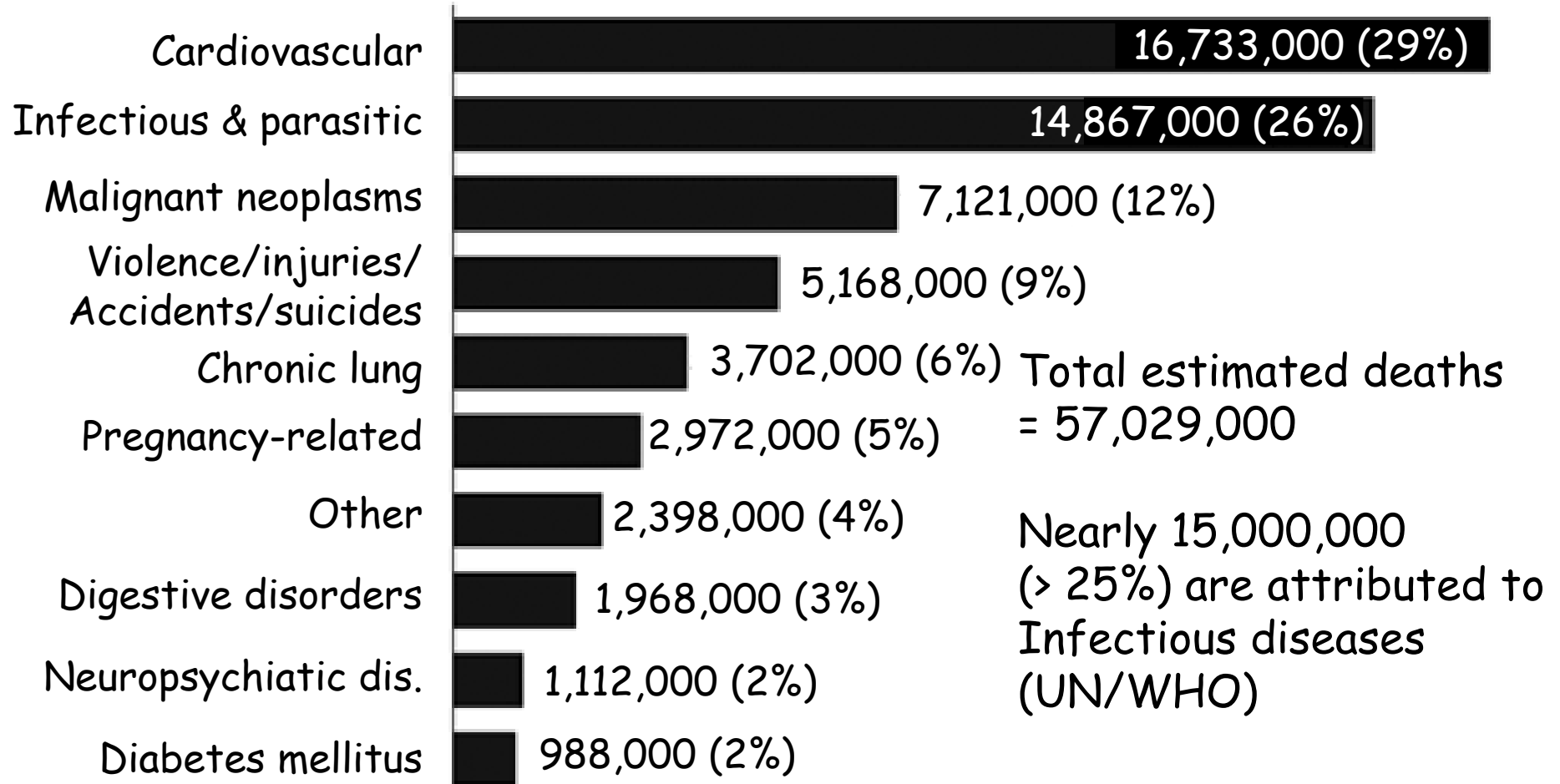


Source: *Science* 307 (25 March, 2005), p.1860

Reported Coccidioidomycosis Cases U.S. & Territories 2002

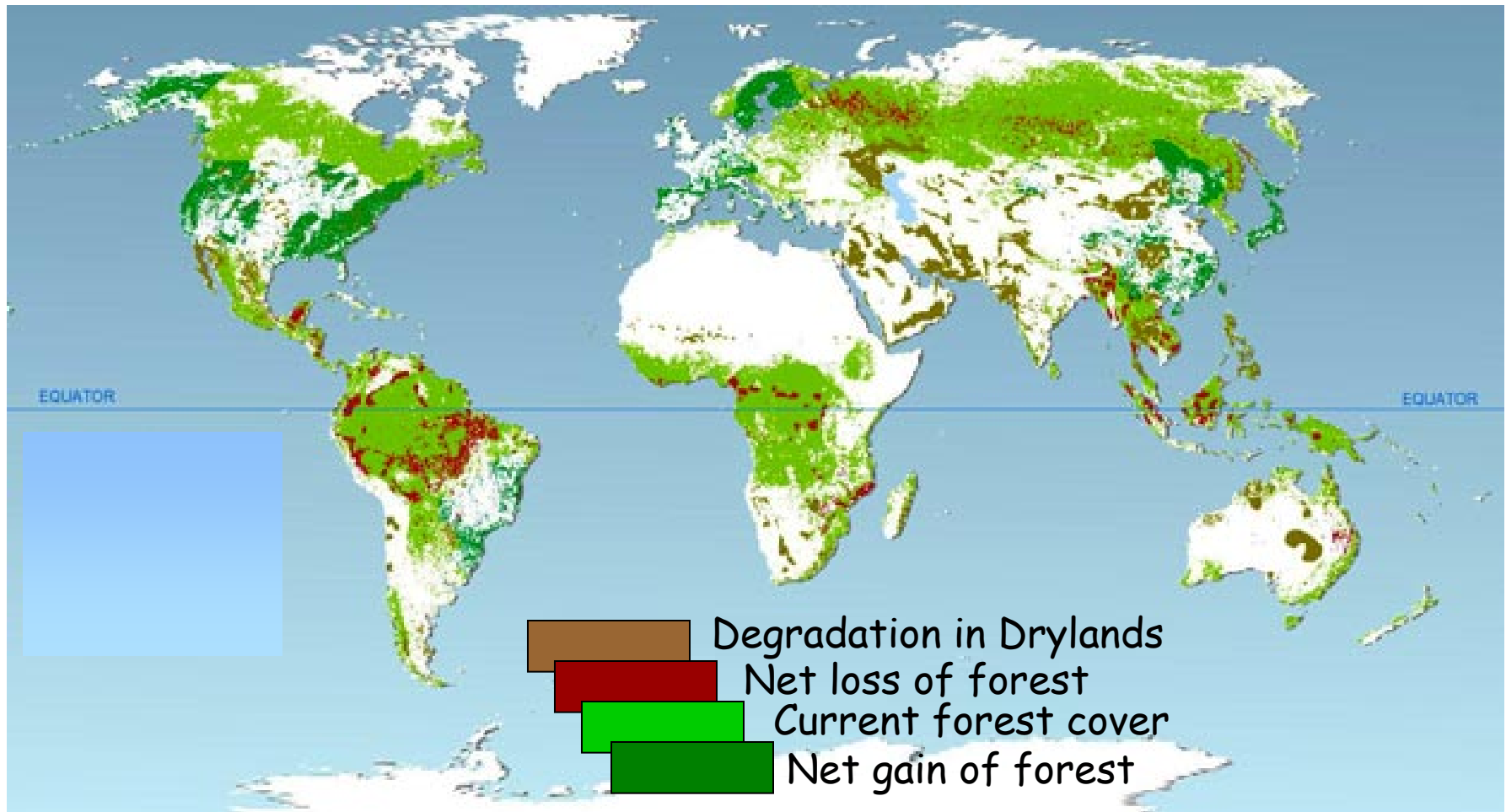


Leading Causes of Death, Worldwide: Est. for 2002



Source: Emerging Infectious Diseases, 2005
Centers for Disease Control and Prevention

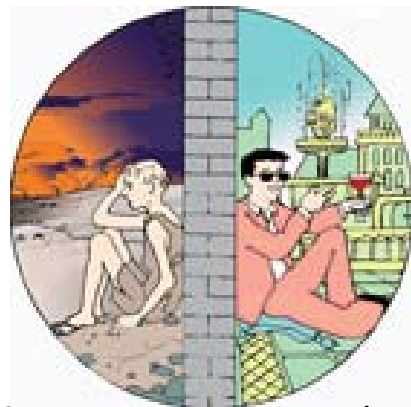
Areas Reportedly Undergoing High Rates of Land Cover Change---last few decades



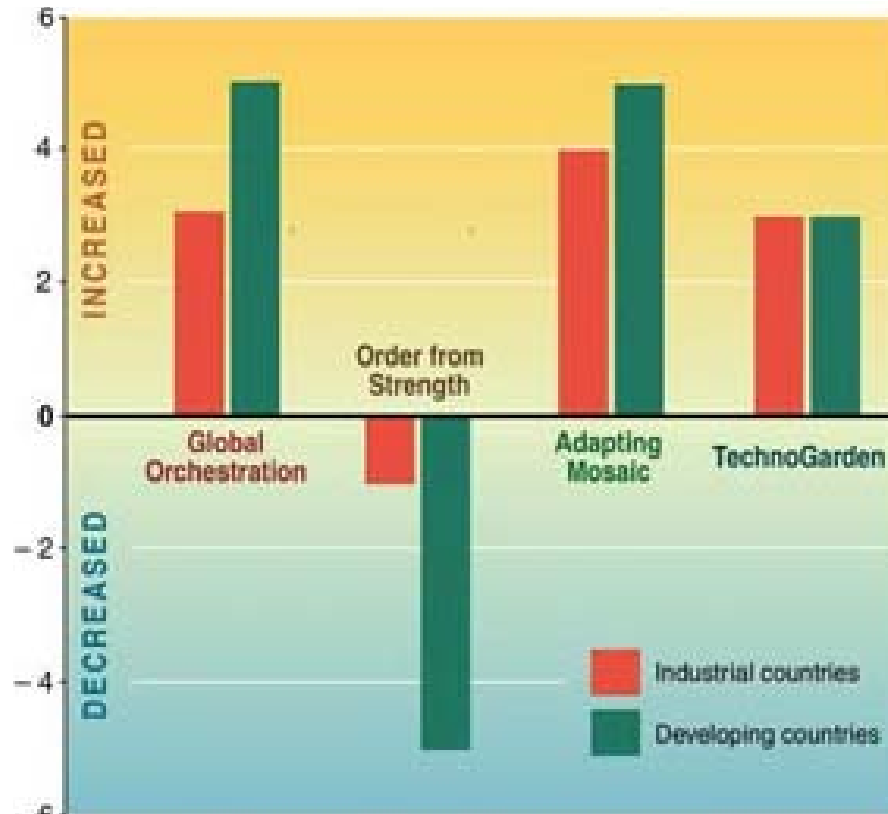
Source: Millennium Ecosystem Assessment

Net Change in Components of Human Well-being

Global Orchestration



Order from Strength



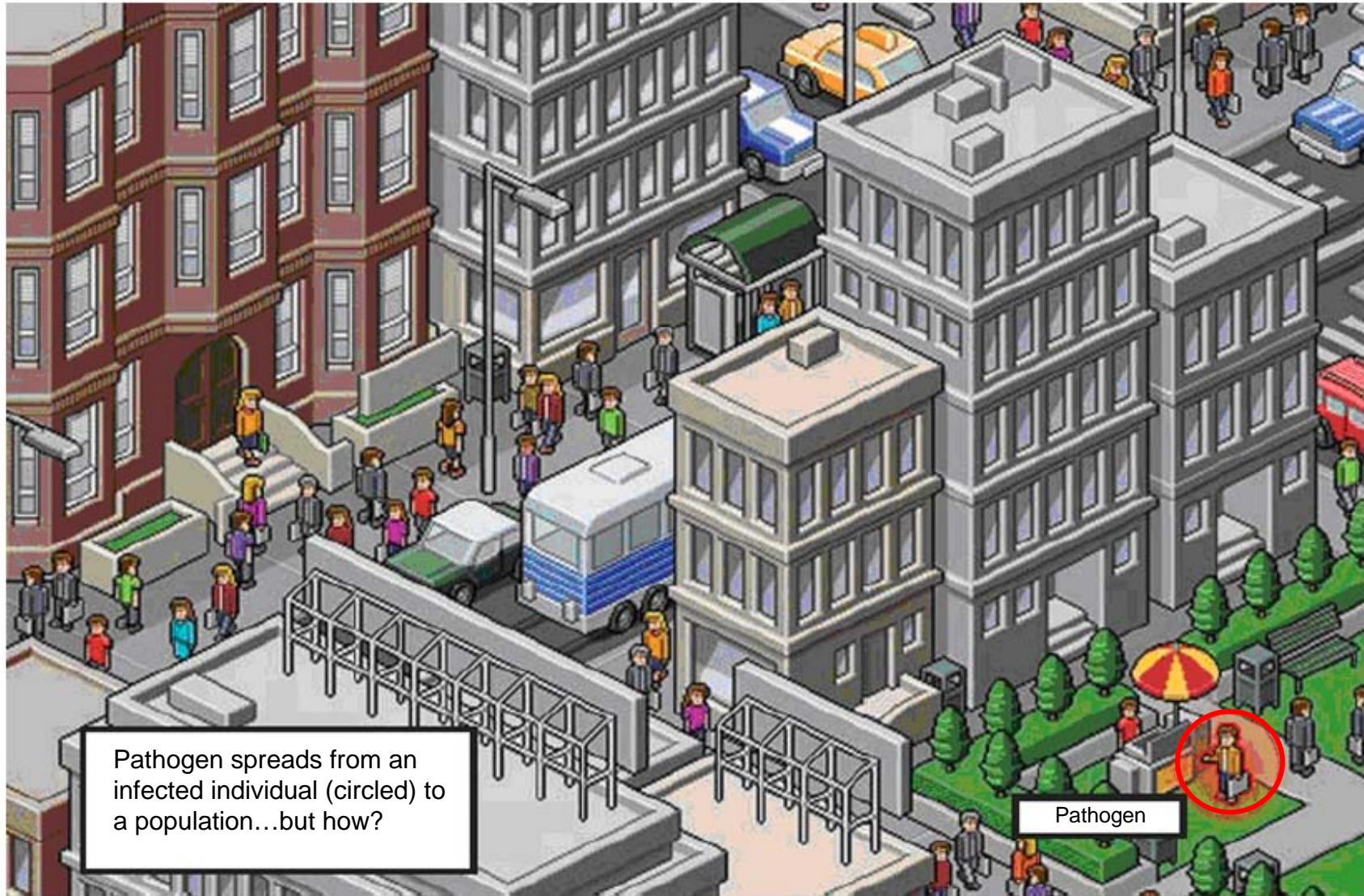
TechnoGarden



Adapting Mosaic

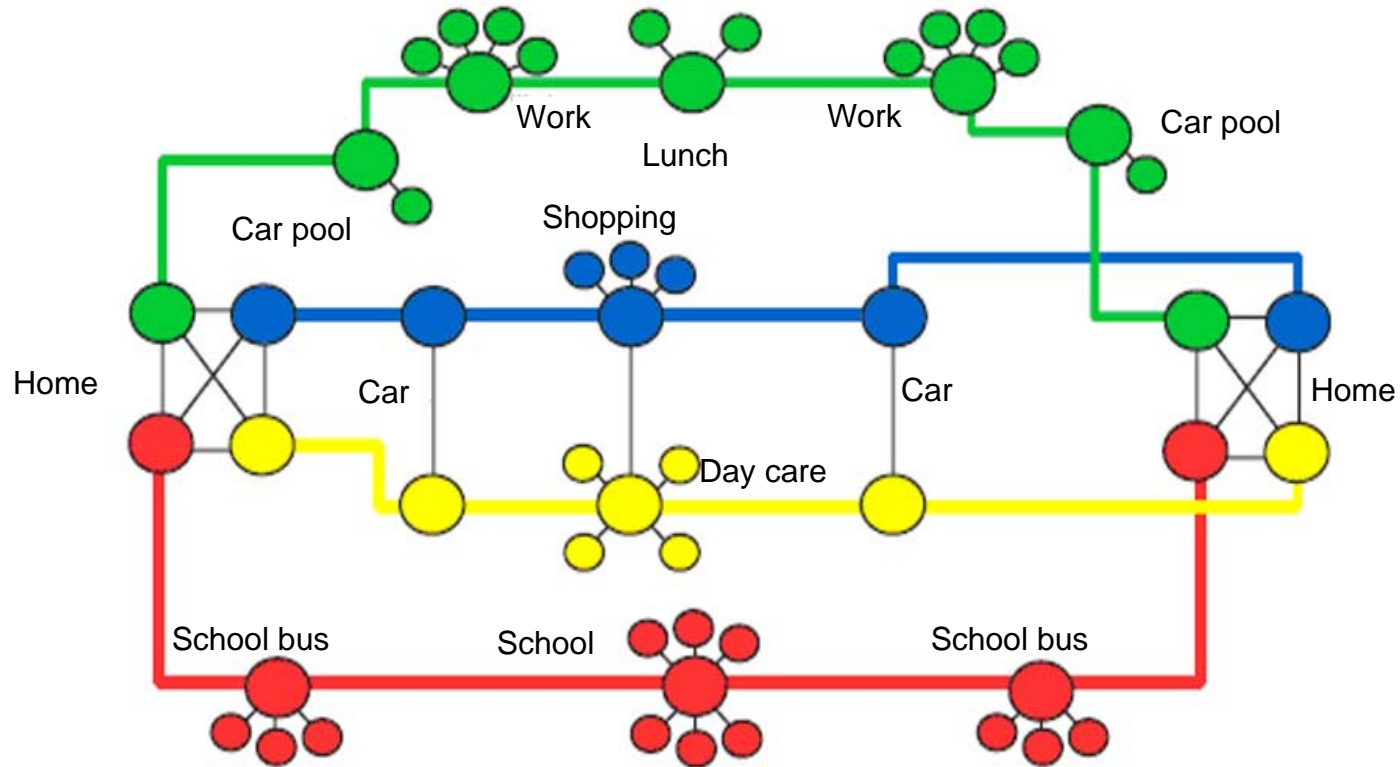
Scenarios:
Reactive on left; Proactive on right

Simulated Smallpox Epidemic

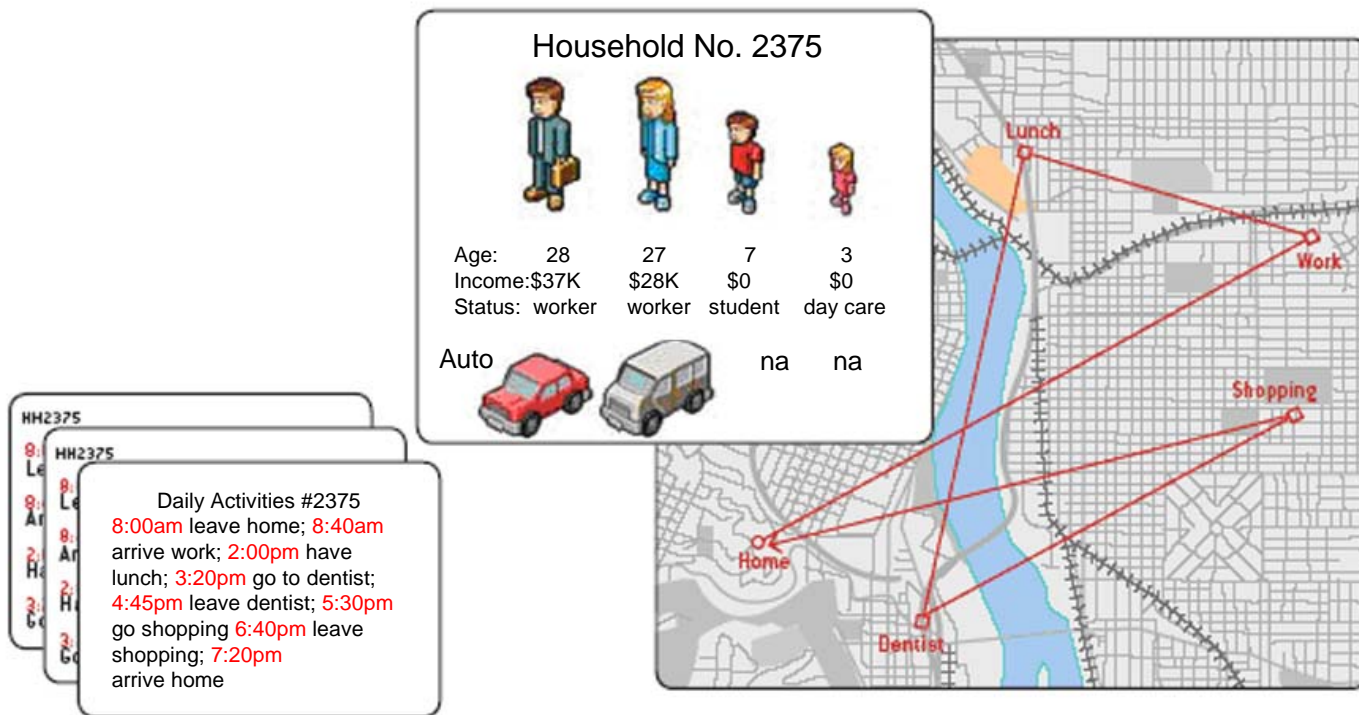


From: Barrett et al. (March) 2005. Scientific American

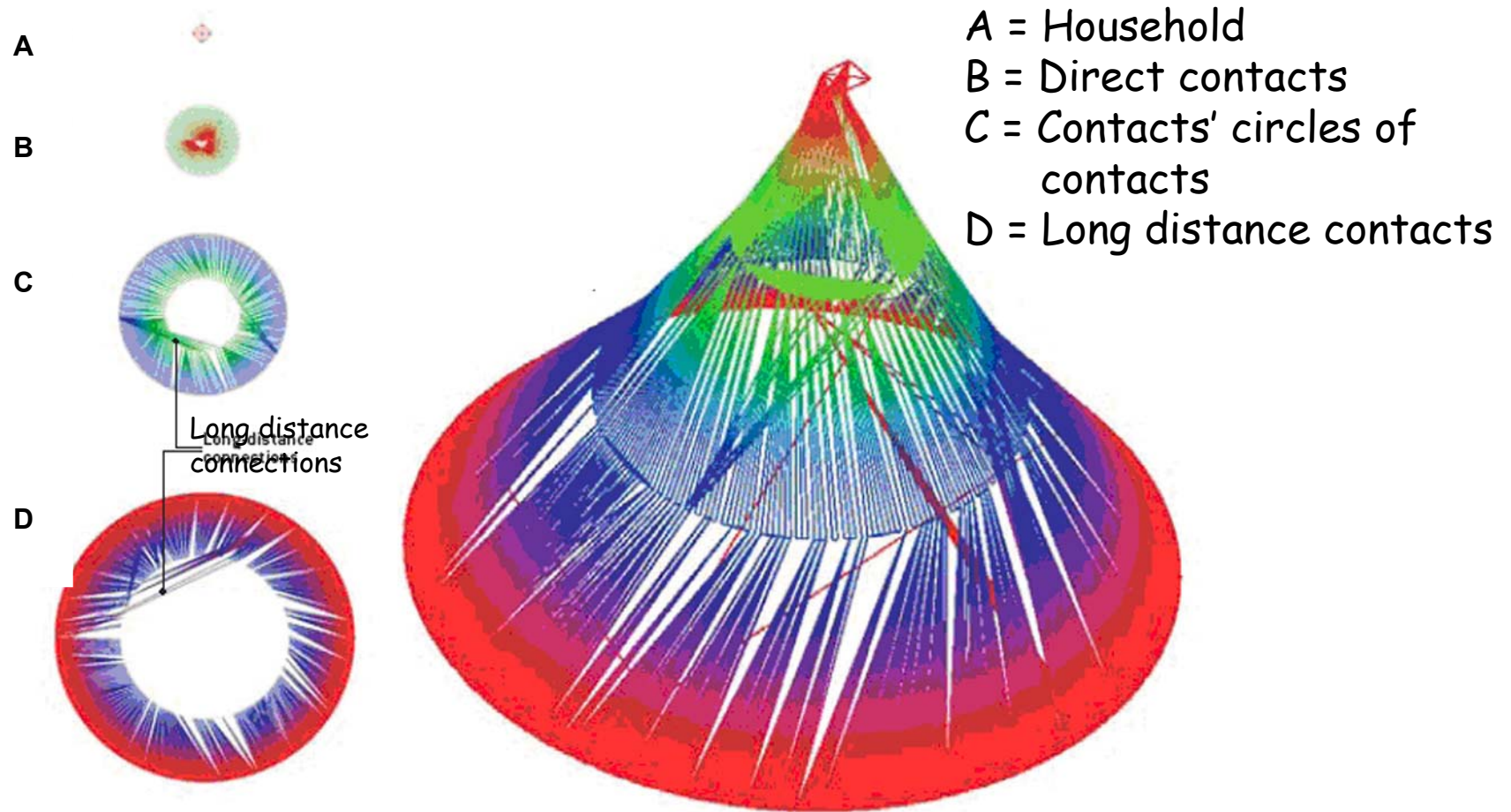
One Family's Network of Daily Human Contacts



Database of Family Members And Activities



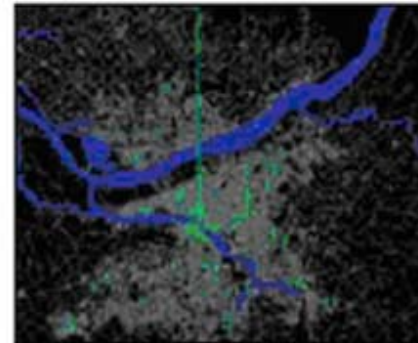
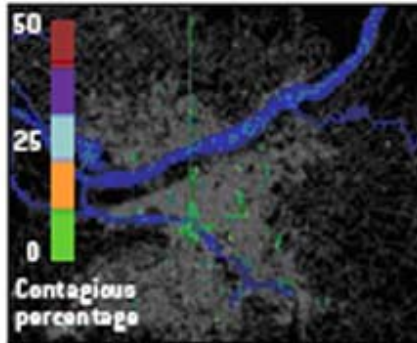
Spread to a Global Epidemic



Simulated Epidemic in Portland, Oregon

No response

Infected: 1,281
Dead: 0

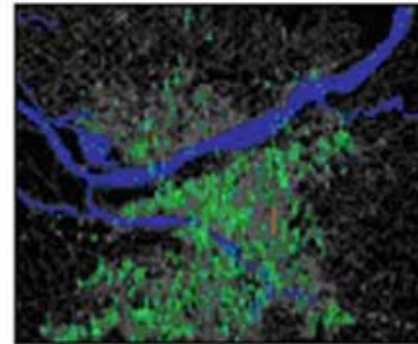
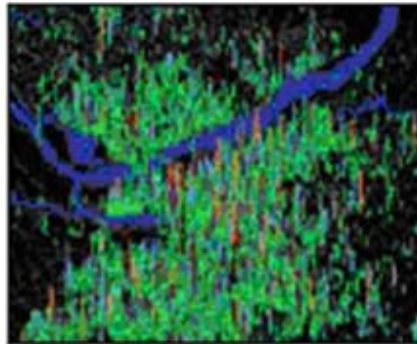


Targeted vaccination and quarantine starting day 14

Infected: 1,281
Vaccinated: 0
Dead: 0

Day 1: Undetected Smallpox Release

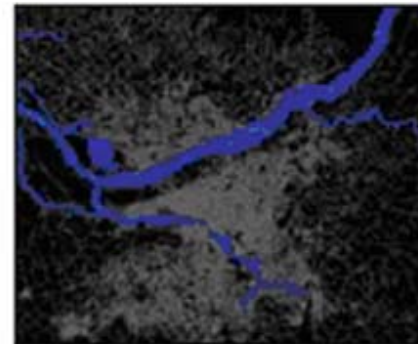
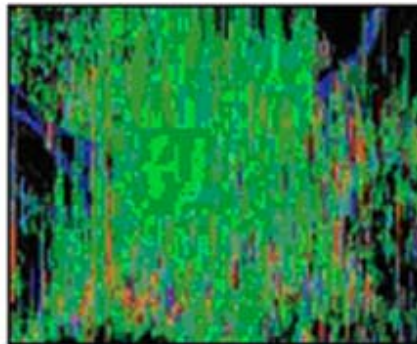
Infected: 23,919
Dead: 551



Infected: 2,564
Vaccinated: 30,560
Dead: 312

Day 35: Smallpox Epidemic

Infected: 380,582
Dead: 12,499



Infected: 2,564
Quarantined: 35,725
Vaccinated 37,207
Dead: 435

Day 70: Epidemic Uncontained or Contained