The Bird's Eye View of Health

Remote Sensing Applications for Public Health


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CDC ATSDR

Remote Sensing:
Who? What? Where?

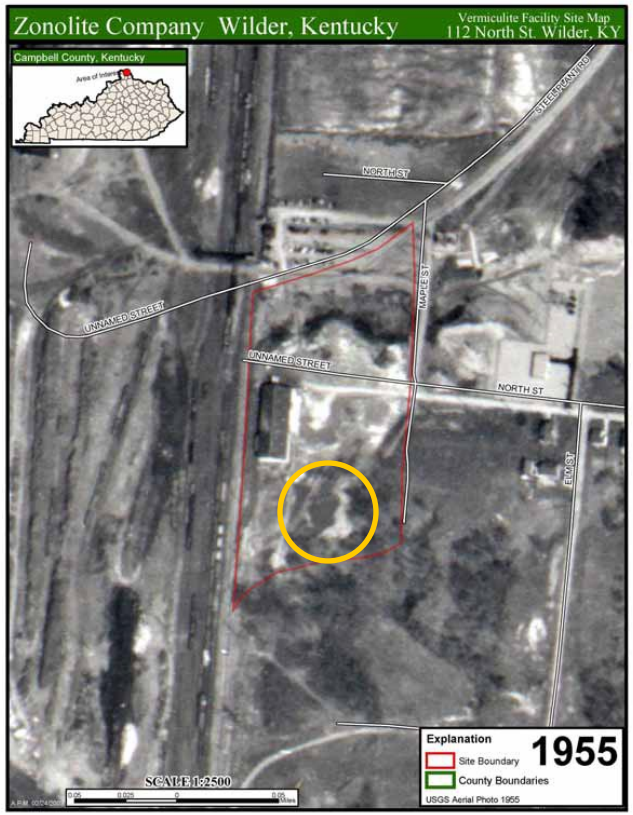
Aerial Photography

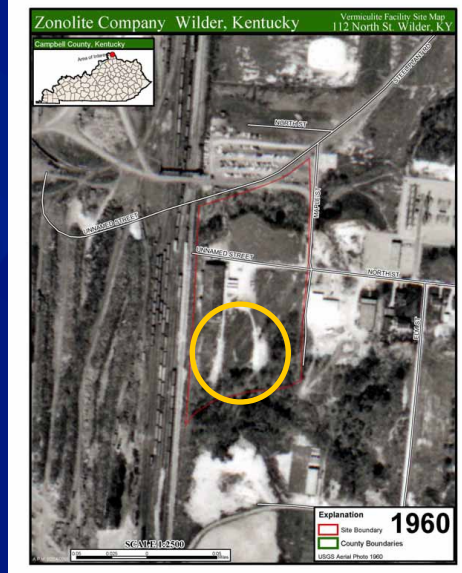
Courtesy of Steven Bullard (CDC)

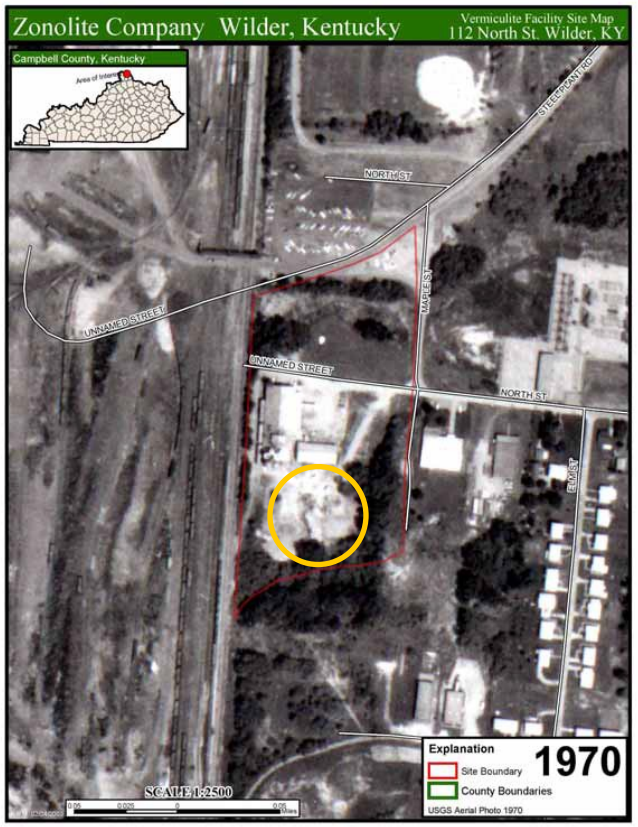
Satellite Imagery

Source: IKONOS, NASA

Aerial Photography:







Courtesy of James Durant (CDC)

ATSDR (2005). WR Grace and Company – Zonolite CO Wilder, ATSDR Health Consultation. http://www.atsdr.cdc.gov

Aerial Photography for CDC Emergency Response:

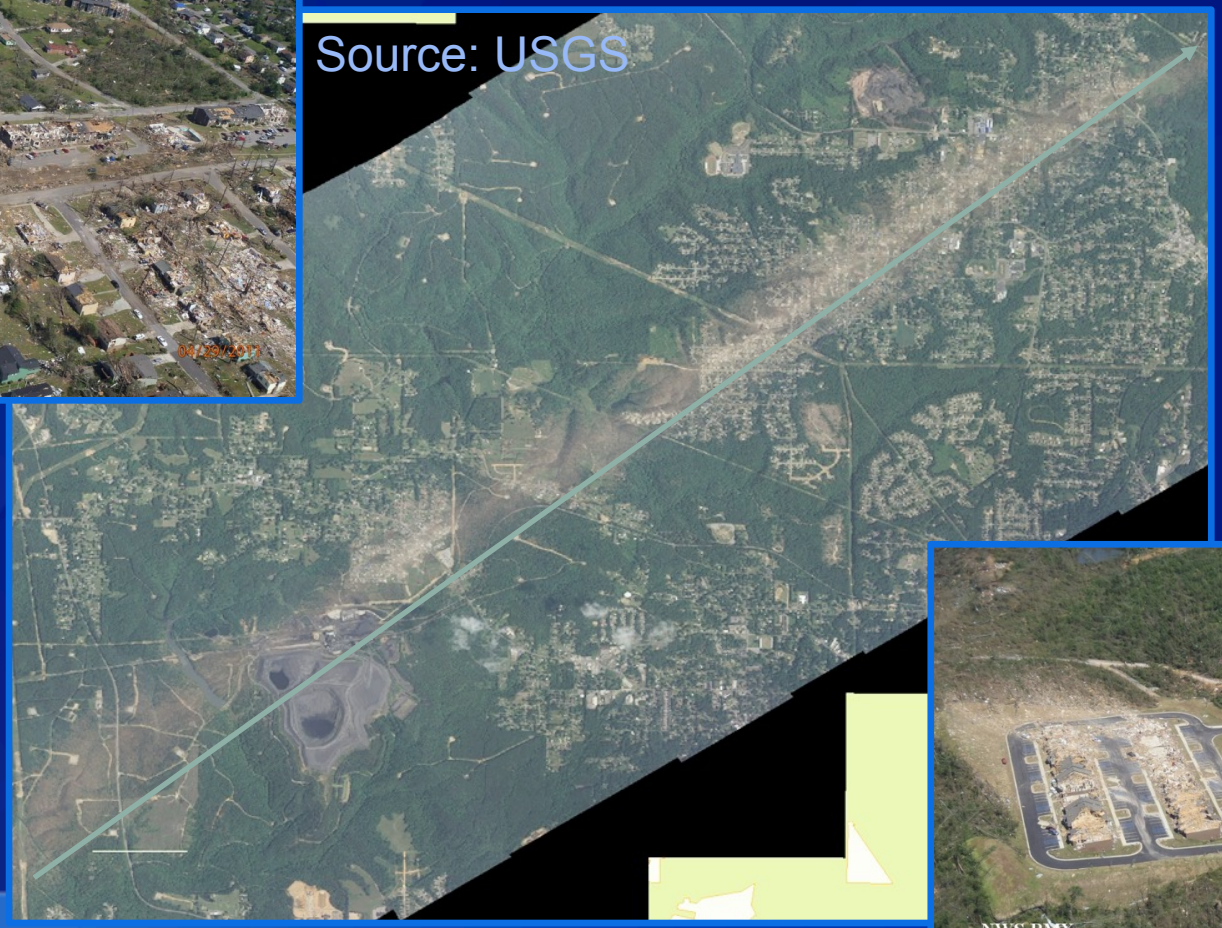
Tornado – Tuscaloosa, Alabama (April 2011)

- **Public Health Uses:**
  - **Preliminary assessment of heavily damaged structures**
  - **Guides further analysis to identify age of structures (US Census) and potential for asbestos**
  - **Notify responders for potential asbestos exposure**

Courtesy Steve Bullard and Robert Neurath (CDC)

Aerial Photography for CDC Emergency Response:

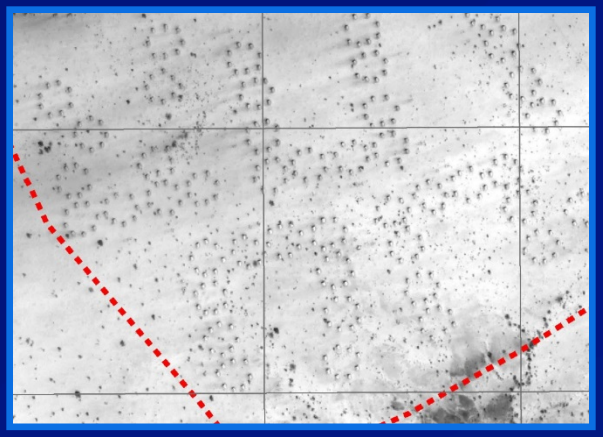
Tornado – Tuscaloosa, Alabama (April 2011)



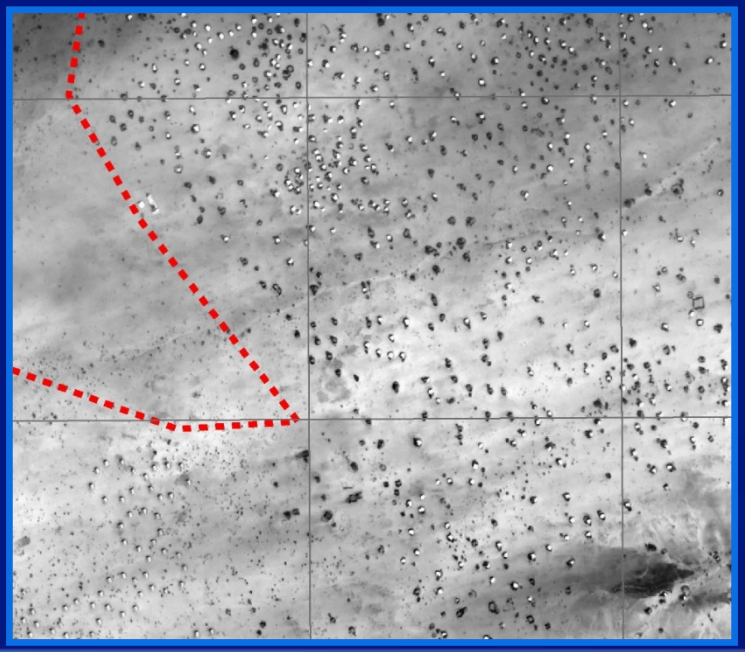
Aerial Photography for Refugee Health

Problem:

- Need to quickly assess refugee populations to provide needs assessment
- Difficult to acquire aerial photography in developing countries



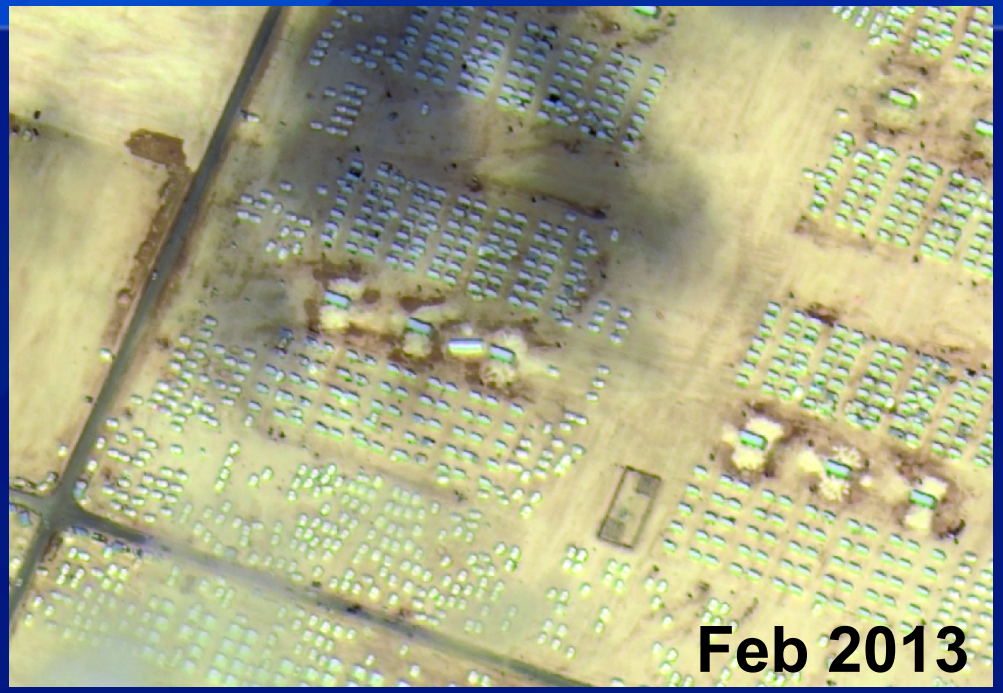
Organized Refugee Camp

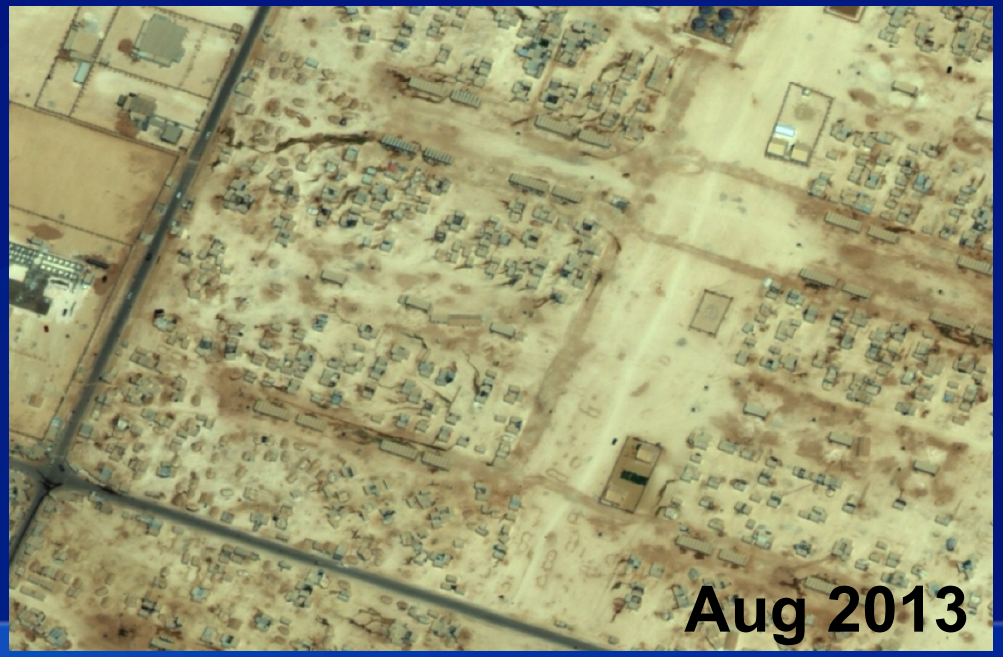


Spontaneous Refugee Camp – Random Settlement Pattern

Problem:

- Quickly changing situations
- Conducting a population census is difficult and time consuming

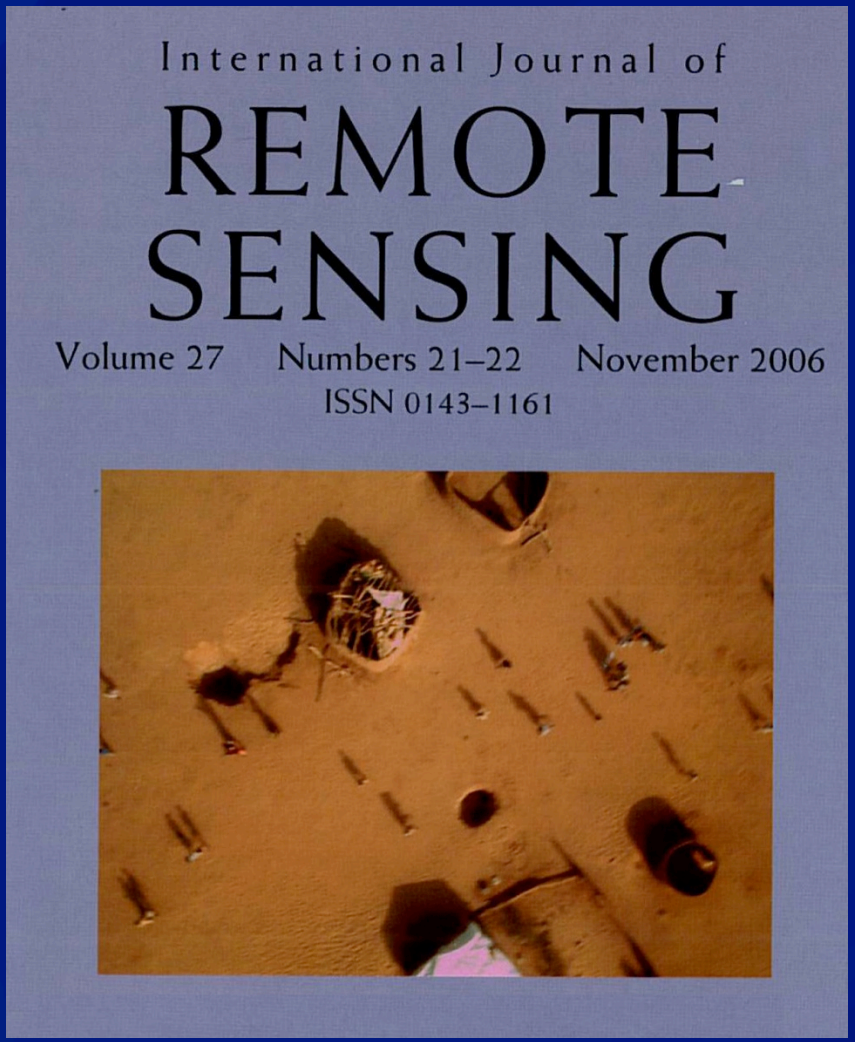




Aerial Photography for Refugee Health

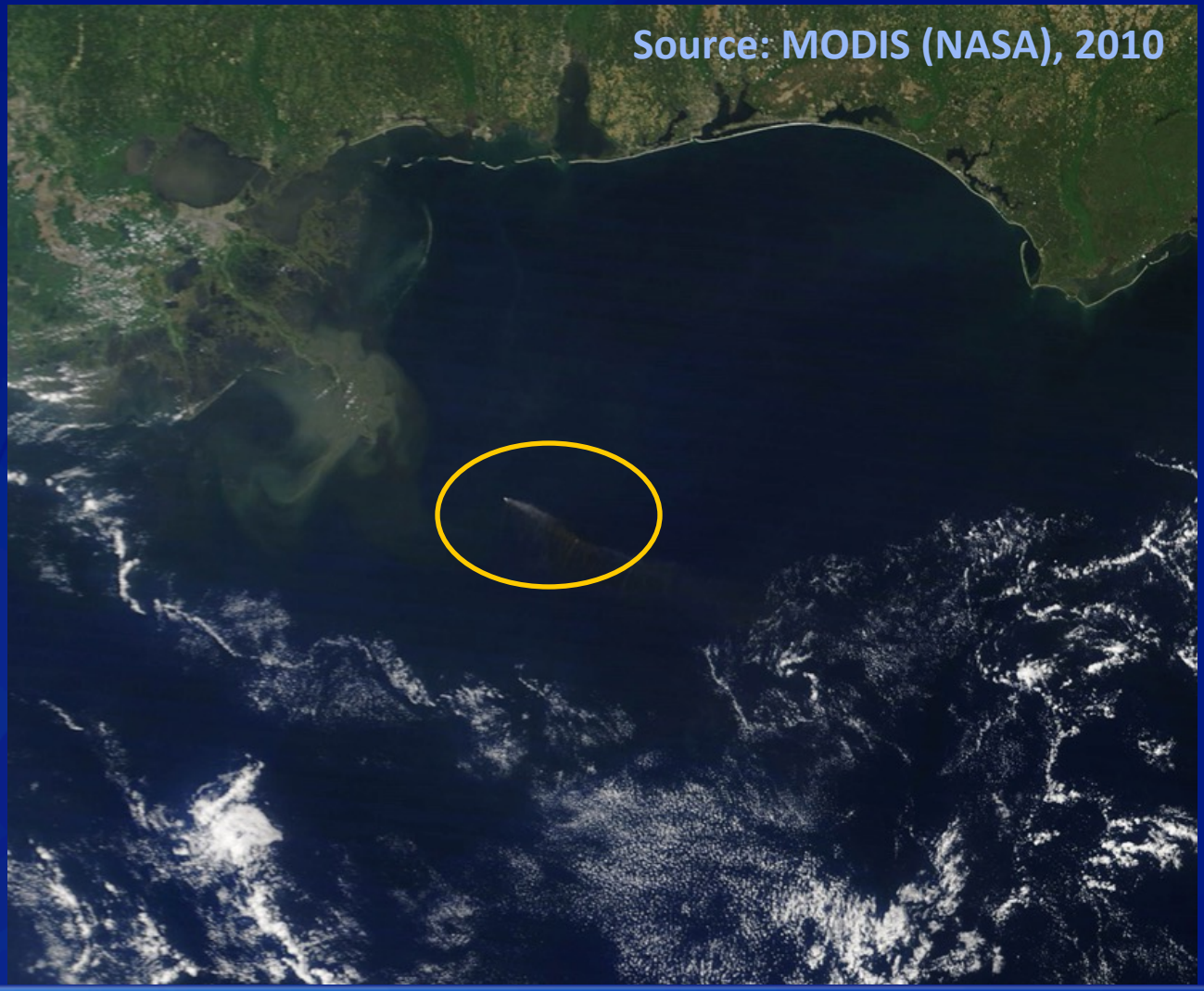
Application:

- Aerial photography to estimate population
- Aerial photograph from a kite (low-tech and low cost)



Sklaver B, Manangan A, Bullard S, et al. "Rapid imagery through kite aerial photography in a complex humanitarian emergency." International Journal of Remote Sensing. 2006, 27(21): 4709-4714.

Satellite Imagery:
Who? What? Where?

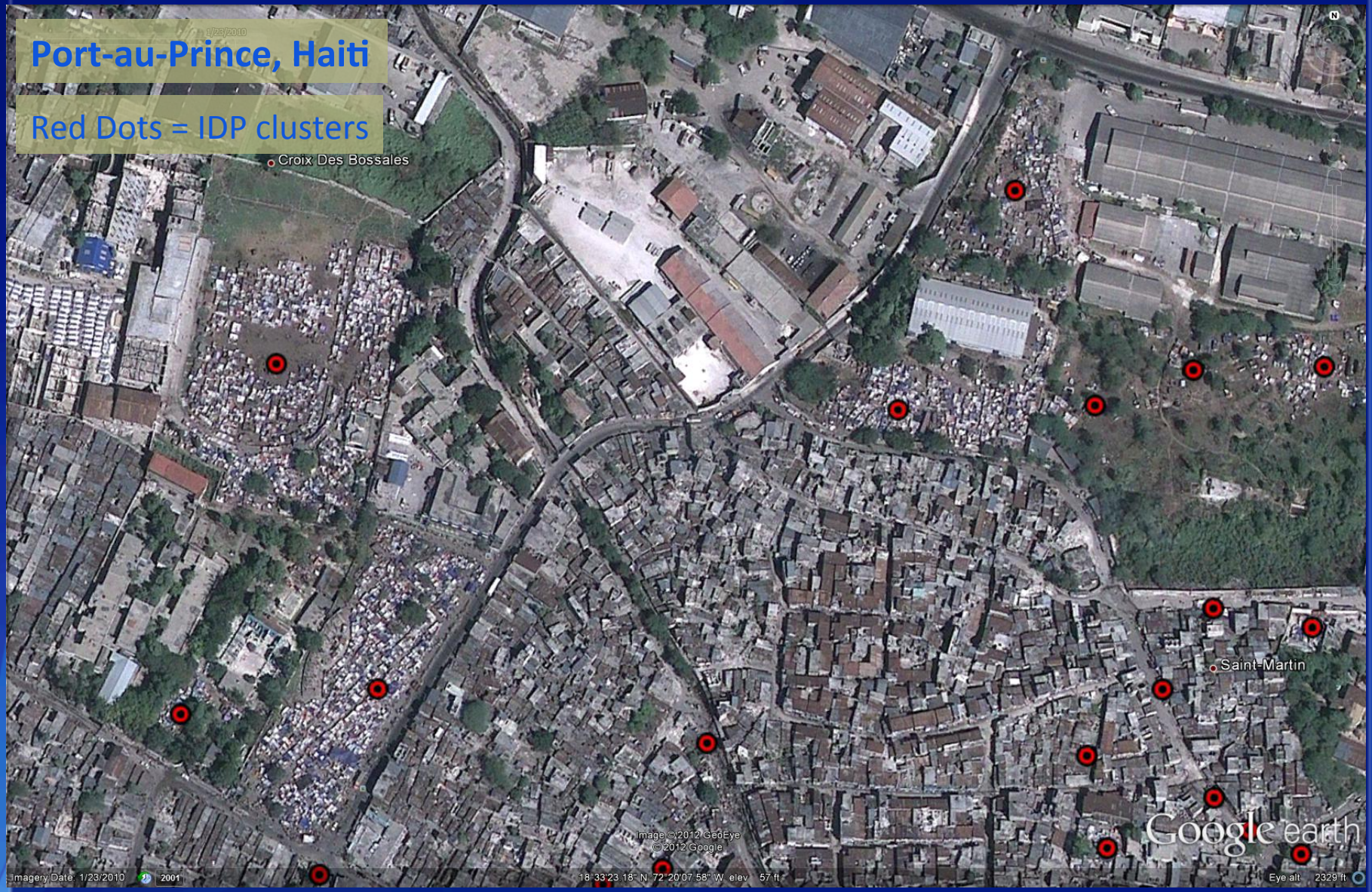


2010 Haiti Earthquake

During the CDC response to the 2010 Haiti earthquake, satellite imagery (Google Earth) were used locate shelters of Internally Displaced Populations (IDPs) and track placement changes over time.

Source: Google Earth

Courtesy: (Steve Bullard, CDC)

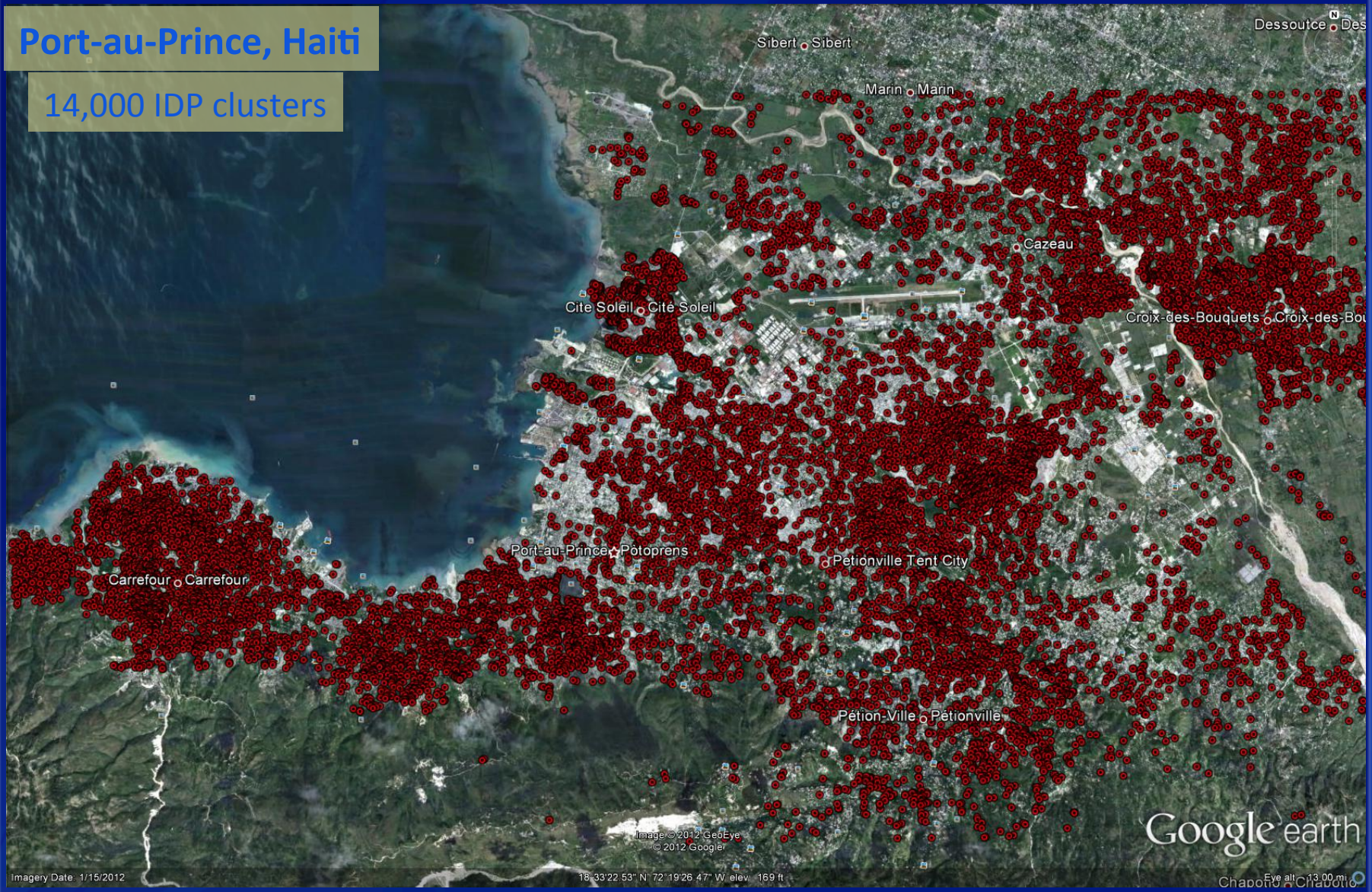


Courtesy: (Steve Bullard, CDC; Robert Neurath, CDC)

Source: Google Earth

Port-au-Prince, Haiti

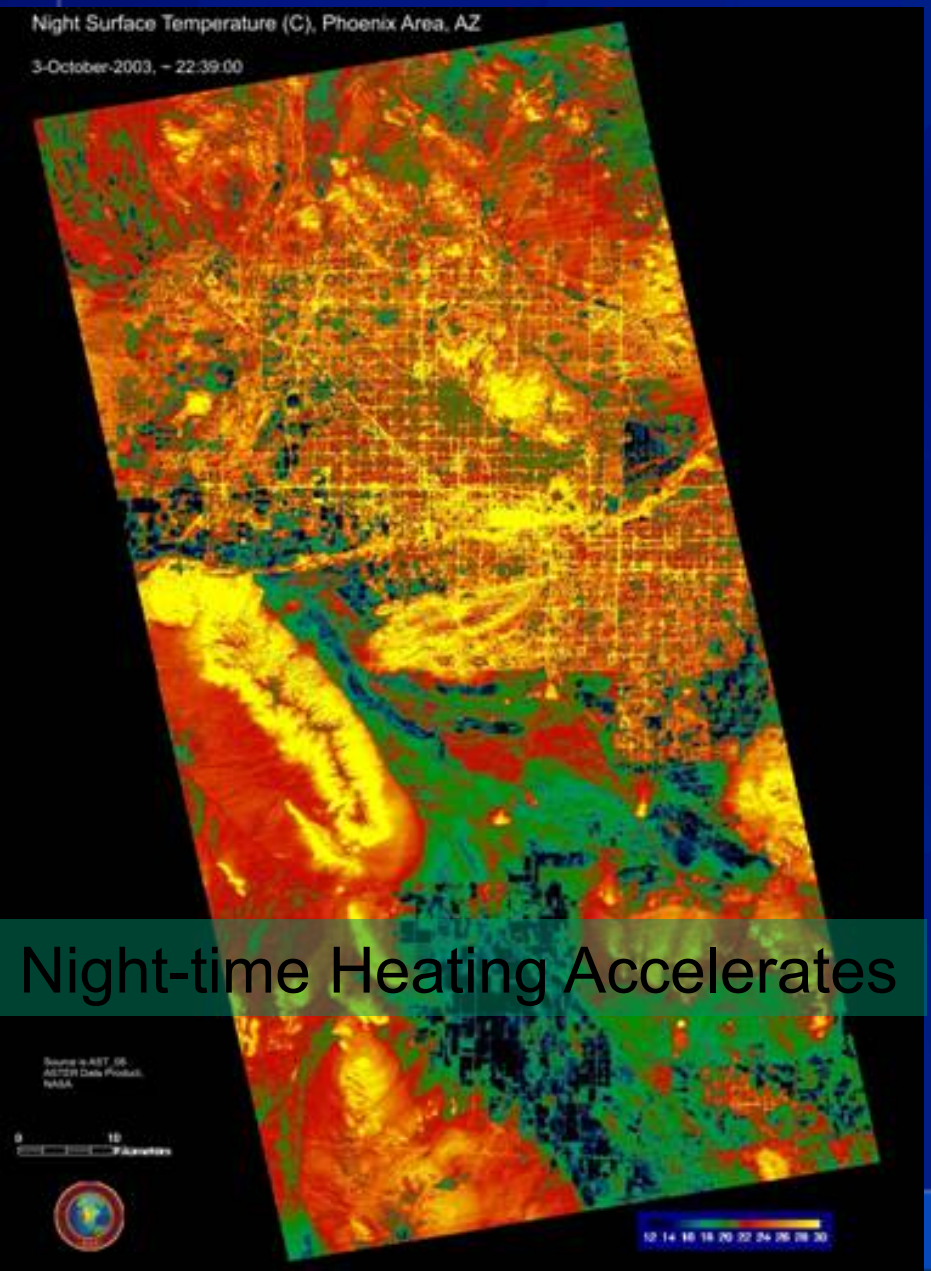
14,000 IDP clusters



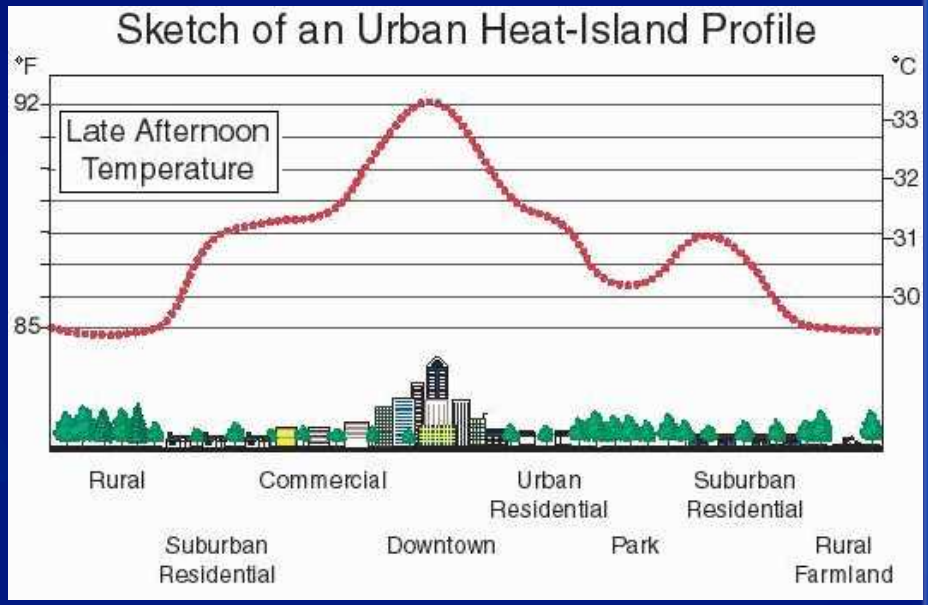
Courtesy: (Steve Bullard, CDC; Robert Neurath, CDC)

Source: Google Earth

Urban Heat Island can add 7° – 12° F



Night-time Heating Accelerates



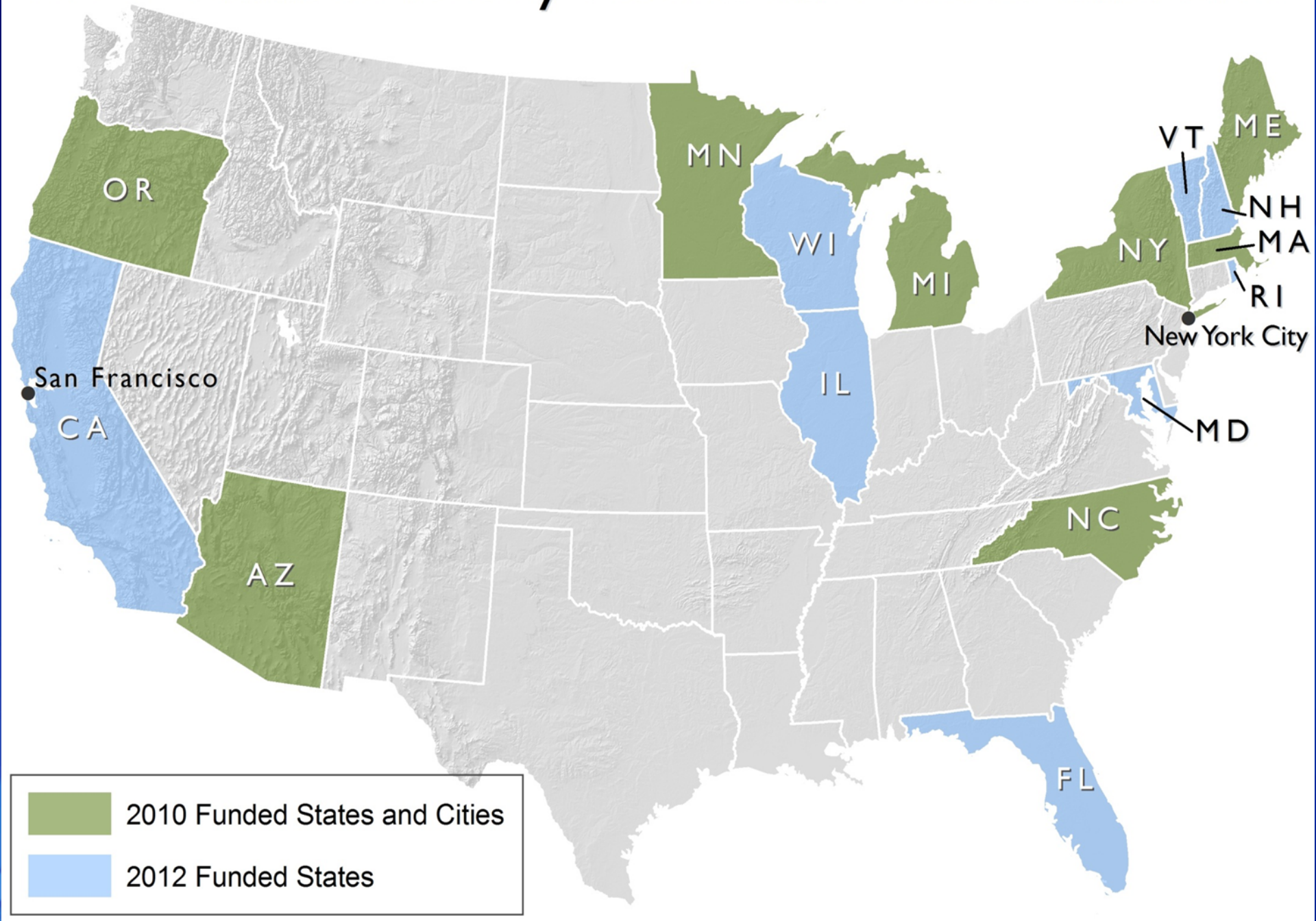
Thermal Satellite Image of Phoenix, AZ
Night Surface Temperature

Climate-Ready States and Cities Initiative

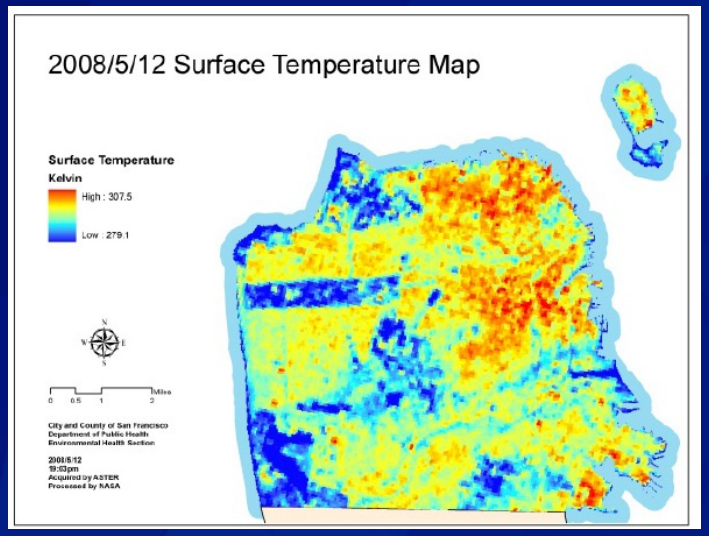
- **CDC effort to enhance capacity of state and local health agencies to deal with health challenges associated with climate change**

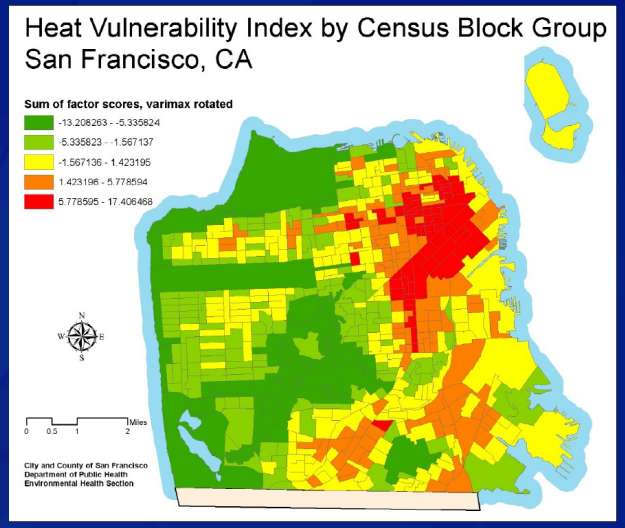
- **CDC accomplishes this by**
  - Funding 18 state and local health departments
  - Providing framework and tools for planning, implementing, and evaluating climate adaptation strategies
    - Tools to identify populations and places vulnerable to climate impacts
    - Materials to help communicate climate and health issues to public health partners (e.g., extreme heat toolkit)

CDC Climate Ready States and Cities Initiative

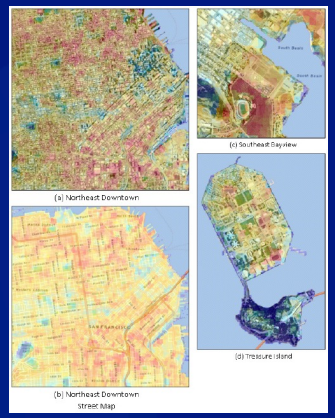


Climate and Health Vulnerability Assessment – Extreme Heat Events (San Francisco, CA)



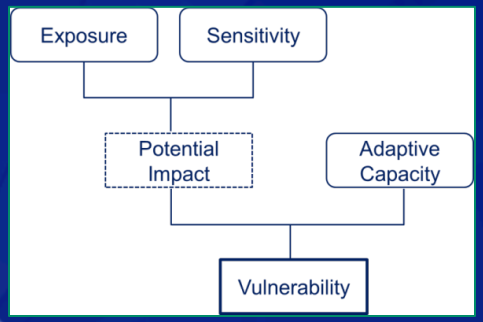


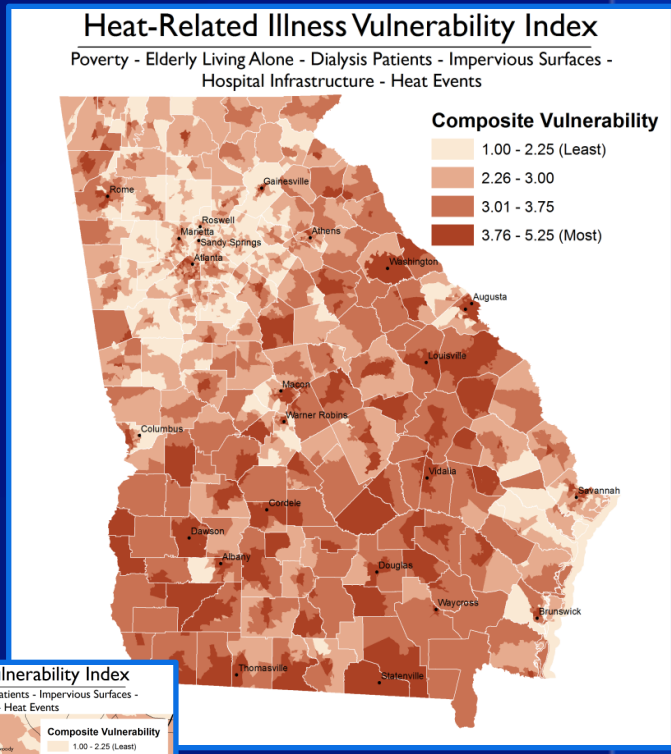
- The city of San Francisco developed a Heat Vulnerability Index
- Thermal remote sensed data (ASTER) were collected to measure the distribution of maximum surface temperature (i.e. potential for heat exposure)

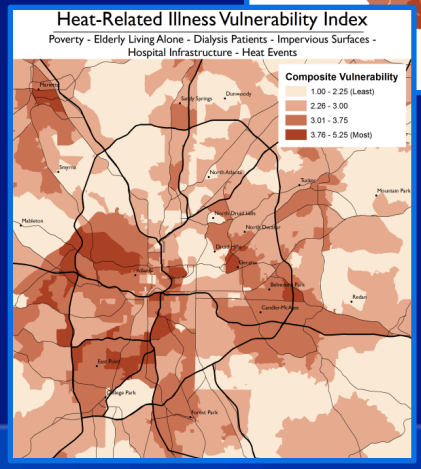


Determine Where Vulnerabilities Exist – Overlay Analysis

- **Sensitivity**
  - Poverty (Census Tract)
  - Elderly Living Alone (Census Tract)
  - Impervious Services (Census Tract)
  - Dialysis Patients (ZIP code)
- **Exposure**
  - Heat Events, >100F Heat Index, 2 days
- **Adaptive Capacity**
  - Hospital infrastructure (County)

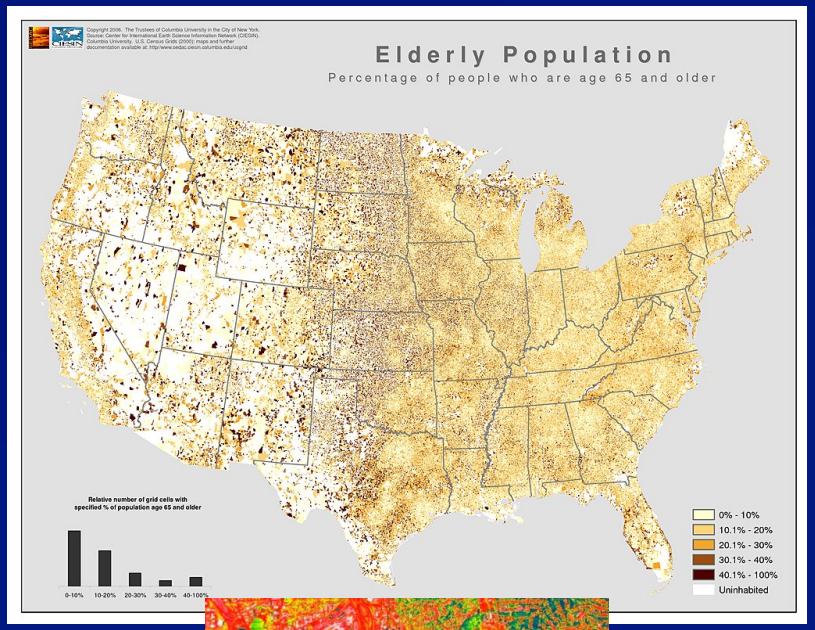


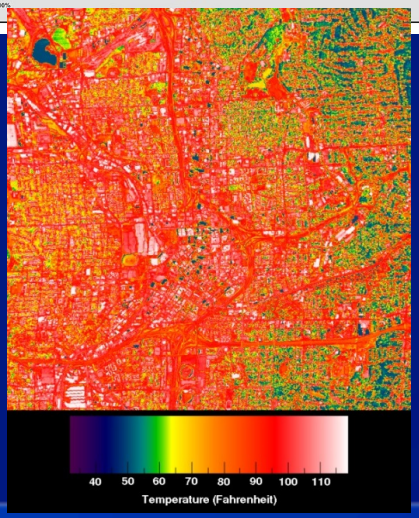




Sensitivity –Vulnerability

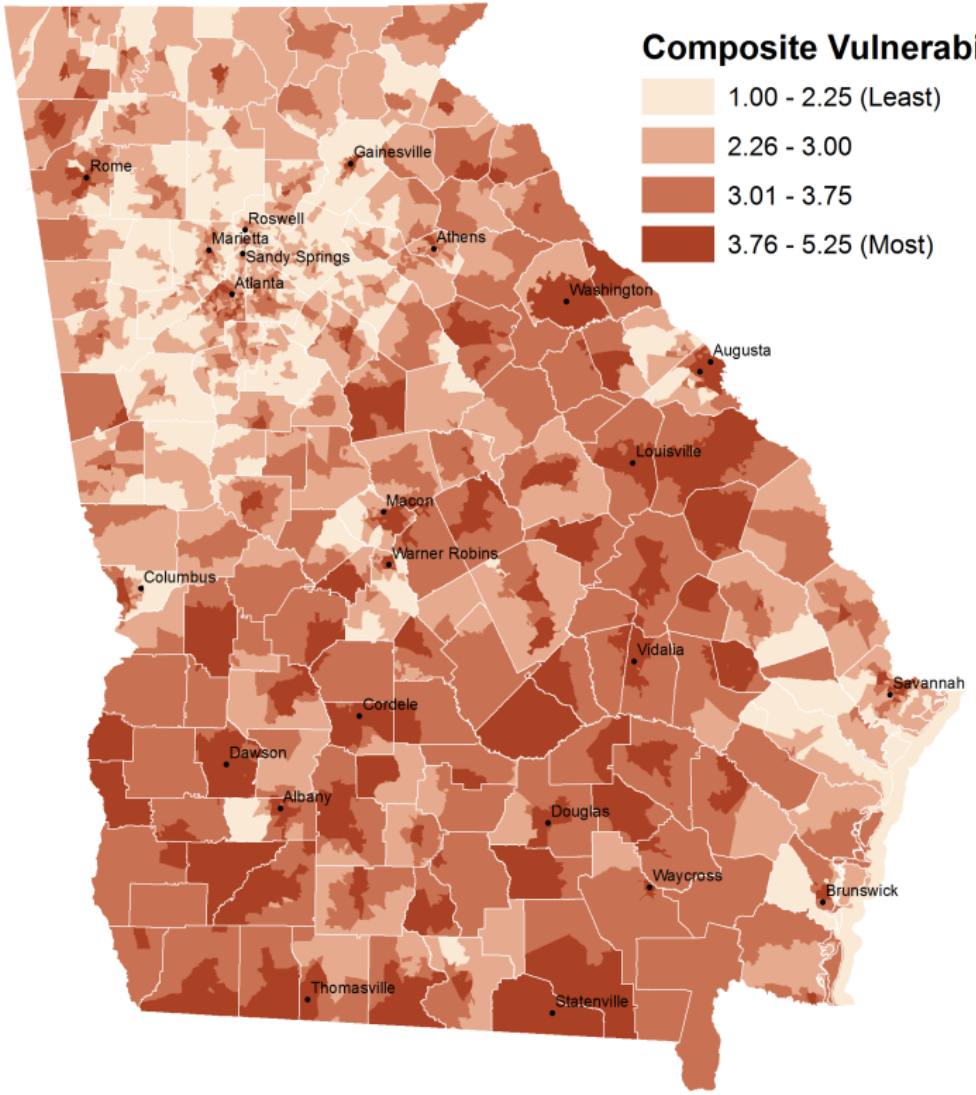
- **Ability to withstand exposures and associated impacts**
- **Three factors**
  - Socio-economic
  - Environmental
  - Biotic (pre-existing health conditions)
- **Measured by census, land-use, or health data (co-morbidities)**





Heat-Related Illness Vulnerability Index

Poverty - Elderly Living Alone - Dialysis Patients - Impervious Surfaces - Hospital Infrastructure - Heat Events



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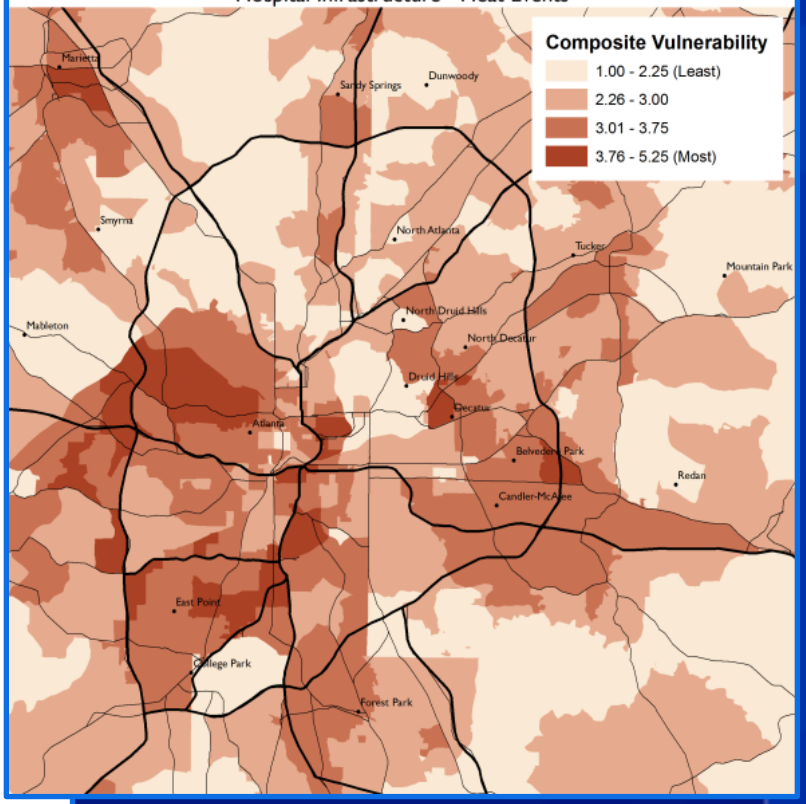

Potential Applications of Remote Sensing for Climate and Health

- Proxy measures for climate-related exposures (e.g. heat, pollen)
- Land cover and land use characterization for health studies
- Wildfire risk assessments
- Flooding assessment changes (landcover and landuse)
- Use of satellite imagery for ecological niche modeling for vector-borne diseases

Thank You

Contact:

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