The Bird’s Eye View of Health
Remote Sensing Applications for Public Health

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Remote Sensing:
Who? What? Where?

Aerial Photography

Satellite Imagery

Courtesy of Steven Bullard (CDC)

Source: IKONOS, NASA
Aerial Photography:


Courtesy of James Durant (CDC)
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

Source: USGS 2011

Courtesy Steve Bullard and Robert Neurath (CDC)
Aerial Photography for CDC Emergency Response:
Tornado – Tuscaloosa, Alabama (April 2011)

Source: USGS
Aerial Photography for Refugee Health

Problem:

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

Satellite Imagery:
Who? What? Where?

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

Source: Google Earth

Courtesy: (Steve Bullard, CDC)
Port-au-Prince, Haiti

Red Dots = IDP clusters

Courtesy: (Steve Bullard, CDC; Robert Neurath, CDC)
Port-au-Prince, Haiti

14,000 IDP clusters

Source: Google Earth

Courtesy: (Steve Bullard, CDC; Robert Neurath, CDC)
Urban Heat Island can add 7° – 12° F

Sketch of an Urban Heat-Island Profile

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)
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)
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

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The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.