Advancements...

1. Next Generation Vulnerability Assessments
2. Response Strategies
3. Housing – protective element
Vulnerability = Exposure (physical) + Sensitivity (social)
Exposure 1: Environmental Exposure

**Indicators:**
Impervious Surface Area Without Tree Canopy
Exposure 2: Housing Quality

**Indicators:**
Proportion Renter Units With Less than 4 Rooms
Exposure Index

Components:
- Rental Property
- Environmental Exposure
Sensitivity 1: Social Disadvantage

Indicators:
Poverty
Minority
Less than High School Education
Receiving Supplemental Security Insurance
Indicators:
Total Crime
Property Crime
Violent Crime

Sensitivity 2: Crime

Crime
Low
Medium
High
Ward Boundary
Water
No Population/Data

[Map showing crime sensitivity with different colors representing low, medium, high, ward boundary, water, and no population/data]
Sensitivity Index

Components:
Social Disadvantage
Crime
Vulnerability Index

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- Ward Boundary
- Water
- No Population/Data
Prioritizing Actions

- **Vulnerable People (Orange)**
  - Cooling centers (Fixed and Mobile)
  - Emergency Prep. Workshops
  - Weatherization subsidy programs

- **Vulnerable Places (Pink)**
  - Enhance tree canopy
  - Pervious paving
  - Reflective roofs

- **Vulnerable People/Vulnerable Places (Red)**
  - Cooling centers (Fixed and Mobile)
  - Workshops
  - Weatherization subsidy programs
  - Enhance tree canopy
  - Pervious paving
  - Reflective roofs

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Types of Response Strategies

Beyond emergency response....

1. Air Conditioning (A/C) strategies
2. Building Envelope
3. Neighborhood Characteristics
Strategy 1: Increase A/C

- Local implications – more waste heat and utility poverty

- Regional implications – more black outs – peak energy demand for many of the regions of the world now occurs in summer not winter

- Global implications – this is an adaptation strategy that worsens climate change mitigation (electricity – energy source)

Some short-term gains – Many medium and long-term losses
Relative Strengths and Weaknesses of the Three Strategies
Amend Weatherization Programs to Add Summer Comfort?

- Study site: Cuyahoga County, Ohio
- $6,200 to improve energy efficiency and comfort in low-income housing
Five Structure Types: Wood Frame Basement, Wood Frame Crawl Space, Wood Frame Slab, Solid Wall Basement, Manufactured Housing
What are the impacts of Weatherization on A/C?

Wood Frame House with Basement (84°C)

Pre-weatherization 4,070 KWh Costing $500
Post-weatherization 2,232 KWh Costing $274

Saving 45.2% KWh and $226

A/C System size –
  – Pre-weatherization 6 ton
  – Post-weatherization 3 ton
Solid Red – No Weatherization and Non-Operable Windows

Solid Blue – Weatherization and Operable Window

Gray Zone – Acceptable Indoor Temperature