


Module 4
Social Vulnerability

IDENTIFYING THE CHANGING CLIMATE'S HAZARDS FOR HUMAN HEALTH AND VULNERABLE POPULATIONS

Key Questions

1. What are the health and social impacts of climate change?
2. How do we care for vulnerable populations?
3. How do we consider vulnerable populations in climate change adaptation planning?
4. How do we engage the public, and vulnerable populations in particular?
5. Are there any tools, resources and examples to assist me?

Health and Social Impacts of Climate Change

The Most Vulnerable

Vulnerable populations may include:

- Children, the elderly and the disabled
- Poor or lower-income residents
- Veterans
- Health-compromised community members
- Immigrants
- Marginalized groups
- Single parents
- The homeless
- Those living in vulnerable housing (near floodplains, power plants, etc.)

Chicago's incidence of suburban poor increased 99% in the last decade. 42% of Illinois' children live below the poverty line, like this Peotone, Illinois girl.

Characteristics of The Most Vulnerable

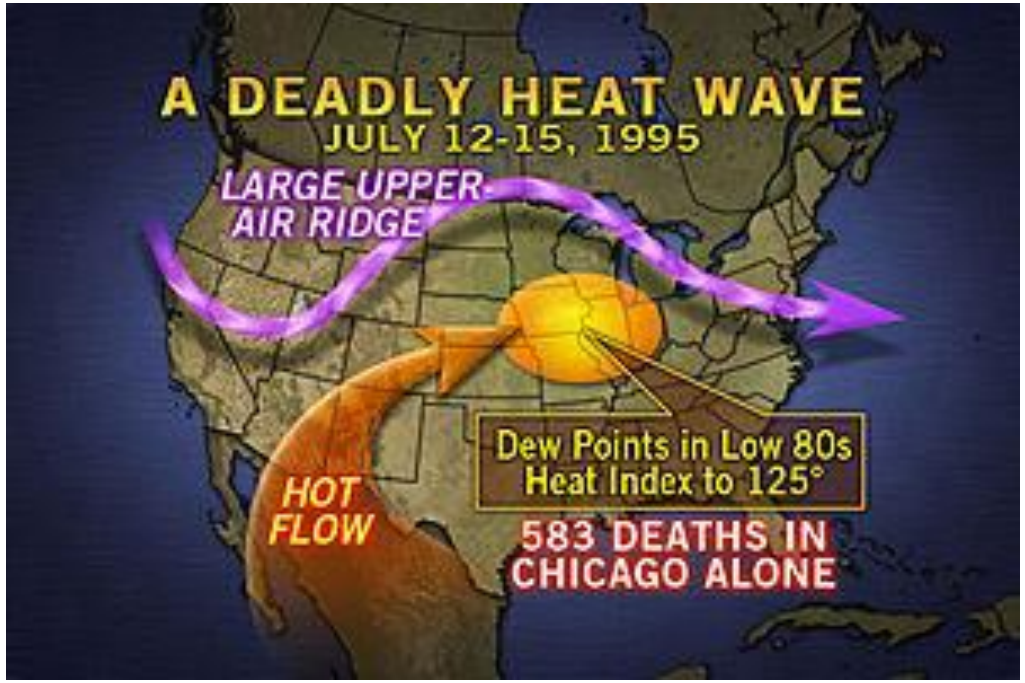
- Limited resources to plan or respond;
- Lack of support networks - cultural and/or linguistic isolation from the bulk of the community.
- Limited awareness and/or lack of education to understand emergency messages;
- Limited opportunity to express their unique needs;
- Presence of significant health problems that curtail ability to respond or recover
  - Dependency on technology, living aids or medication; reduced mobility;
  - Hospitalization or assisted care living.

Single parents may be especially vulnerable to a changing climate due to limited resources and support.

The Health Inequality Gap

Health inequalities arise when certain groups experience inequities and multiple stressors .

- Low-income groups may have difficulty recovering from losses, property damage, or displacement after an extreme event such as a storm (e.g. Hurricane Katrina), or receiving health services in general.
- Among the homeless, extreme weather may worsen pre-existing conditions like mental illness, disease, social isolation and drug use.
- High-rise residents are likely to be exposed to higher temperatures. Many high-rise residents are low-income and new immigrants, with less access to air conditioning.
- Vulnerable communities typically have less green space and trees, leading to poor air quality and the Heat Island Effect in neighborhoods.



The death toll in Chicago's 1995 heat wave totaled 750, with the elderly, children and other vulnerable populations hit hardest.

Health and Social Impacts of Climate Change

- Urban heat
- Air quality
- Water concerns
  - Water quality
  - Increased rainfall and flooding
  - Combined Sewer Overflows
- Changing seasons
- Severe storm events
- Secondary impacts

New York City's 2010 heat wave and 2012 Superstorm Sandy have posed many challenges for both residents and municipal leaders.

Urban Heat and Air Pollution

Associated increase in severity and frequency of:

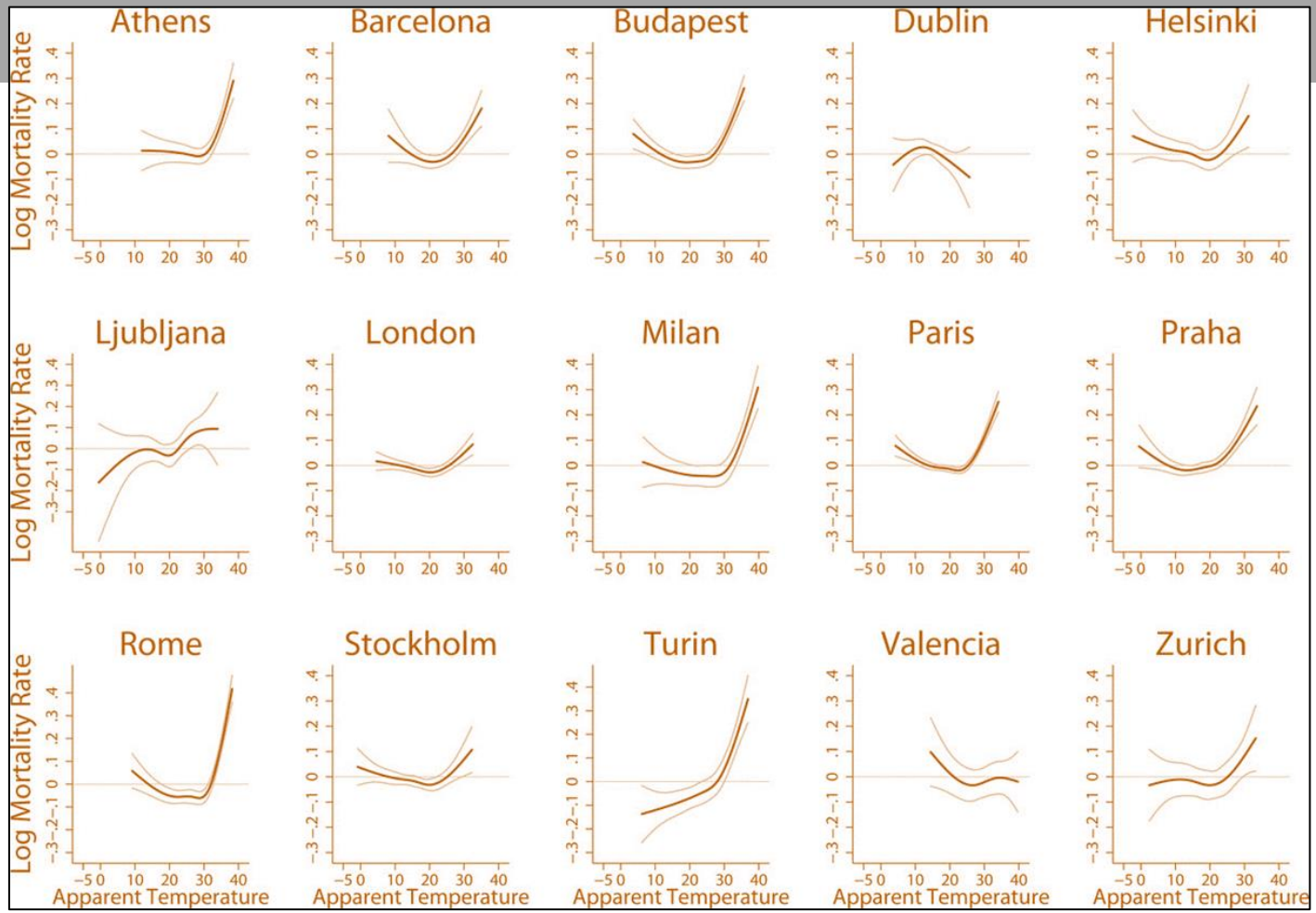
- Heat-related illness (i.e.: heat stroke), dehydration
- Degraded air quality leading to illness, premature morality from cardiovascular and respiratory causes, increased risk of cancer
- Pollutant emissions (for example, ozone alert days)
- Vector-borne infectious diseases

Particularly vulnerable populations:

- Infants and seniors
- Those with chronic illness, compromised immunity or poor health
- Those working outdoors for extended periods of time
- Individuals without access to adequate shelter or cooling mechanisms
- Those living in areas with poor air quality

Daily Max Temp vs Mortality graph

Worldwide, mortality rates increase with increased temperatures, as illustrated by the graph on the right.



Baccinni et al., (2008

Increased Rainfall and Flooding Events

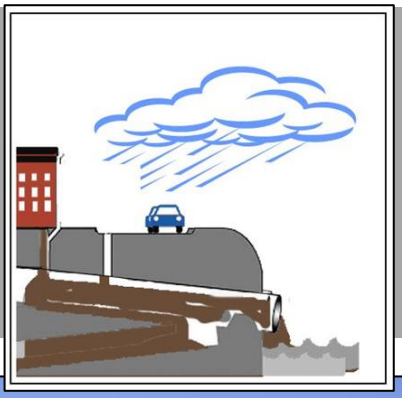
Associated increase in severity and frequency of:

- Lake bacterial contamination from runoff; increase in waterborne disease
- Residential /commercial building structures contaminated by floodwater/ sewage backups
- Mold development in built structures, leading to respiratory illness

Particularly vulnerable populations:

- Residents of low-lying areas or flood plains
- Residents of substandard housing, and/or those who are homeless or under-housed
- Chronically ill or those with impaired immune systems, compromised health

Combined Sewer Overflows



Associated increase in severity and frequency of:

- Water quality problems
- Beach closures
- Human health risks

Particularly vulnerable populations:

- Residents of low-lying areas or flood plains
- Chronically ill or those with impaired immune systems, compromised health

Beach closure at Lake Erie due to *E.coli* contamination.

Changing Seasonal Climate

Associated increase in severity and frequency of:

- Vector-borne disease transmission from insects with longer survival periods in milder winters
- Introduction of new local infectious diseases
- Shifting crop growth and harvest cycles, timber lines and floral / faunal migration

Particularly vulnerable populations:

- Chronically ill or those with impaired immune systems, compromised health
- Communities dependent on natural resources

West Nile virus and other serious diseases are transmitted by insects like mosquitoes.

Severe Storm Events

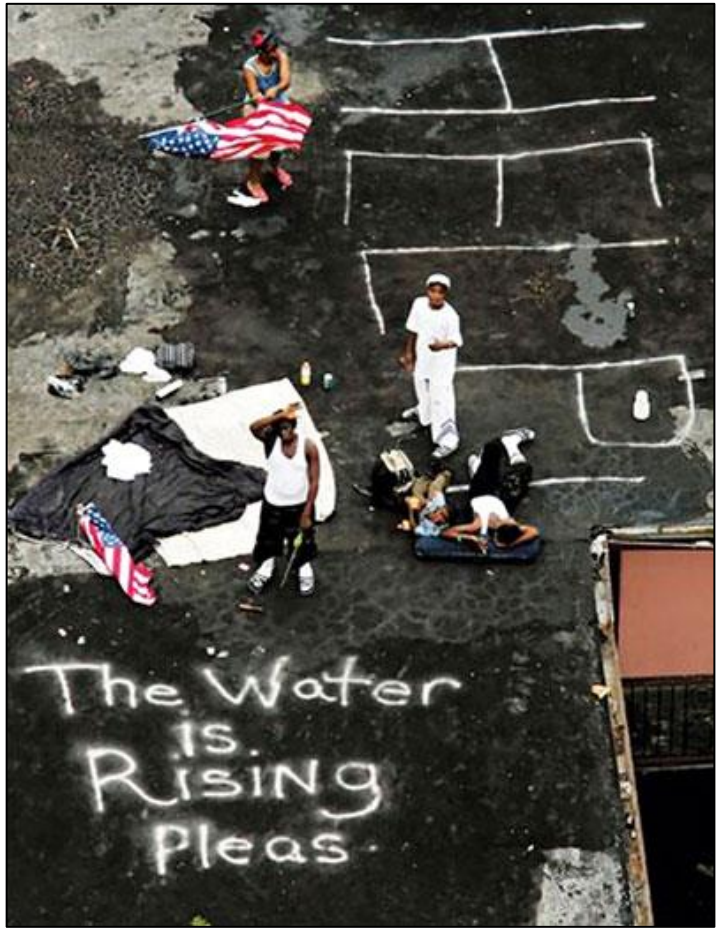
In 2012 alone, there were 11 extreme weather events in the United States, with each costing approximately $1 billion USD in cleanup costs. Every dollar spent on hazard mitigation saves $4 in avoided disaster costs. (National Institute of Building Sciences)

Associated increase in severity and frequency of:

- Extreme storms like Hurricane Katrina and Superstorm Sandy
- Flooding, polar vorteces, drought, wildfire and other disasters

Particularly vulnerable populations:

- Residents of assisted living facilities, nursing homes, substandard housing and high rises
- The homeless, disabled and chronically ill, including patients at hospitals whose health may be threatened by hospital power outages and medication or food shortages due to transit interruption.



Flood victims seek assistance in Hurricane Katrina's aftermath. The storm caused tremendous loss of life and property, and disproportionately affected low-income residents. 2014's polar vortex caused dangerously low temperatures.

Secondary Impacts

Associated increase in severity and frequency of:

- Electricity failure leading to food-borne illness, hypothermia, hospital and transportation outages, and water treatment plant shutdowns
- Food or water shortages
- Physical injury, drowning, electrocution, death
- Health impacts from infrastructure damage and interruptions to ambulance transport and other health services
- Indirect psychological health effects, including mental health and stress-related illness

Particularly vulnerable populations:

- **All**

Storms can damage power lines and cause local outages, creating potentially dangerous conditions for residents and repair crews.

Superstorm Sandy

- Sandy caused $65 billion in damages, with low-income households greatly impacted.
- 43% of the 518,000 households asking for federal aid from Sandy reported annual incomes of less than $30,000.
  - Low-income elderly and disabled NY City public housing residents were stranded in their apartments for weeks due to elevator outages or lack of anywhere to go. Many were unable to make it to food stamp centers for assistance.
  - Floodwaters damaged 402 public housing buildings, with more than 350,000 units in NYC.
  - 82% of properties hit by Sandy were built before 1980, when flood maps and standards were created.
- Storms are not "social equalizers". Severe weather exacerbates economic inequities, and low-income families have fewer resources to prepare for and recover from disasters. Low-income people are particularly vulnerable due to poor housing quality, environmental conditions and economic instability. Additionally, responder biases may negatively impact response times and quality of services provided to low-income populations.
- Low-income individuals are often expected to share the economic burden of disasters, which was once covered publicly. Federal aid programs may favor those who can take on debt. Because the application process for aid is complex, it is helpful if application assistance is available, especially for vulnerable populations that may have reduced English language literacy.

Stranded residents are evacuated after Superstorm Sandy.

Caring for Vulnerable Populations

"When disasters occur, they do not affect everyone in the same way. In emergency planning, it is important to pay special attention to the needs of people who are deemed particularly at risk, or the 'most vulnerable'."

Source: Community-Wide Vulnerability and Capacity Assessment (CVCA), Office of Critical Infrastructure Protection and Emergency Preparedness, Government of Canada, https://www.ccadaptation.ca/en/component/k2/item/2671-community-wide-vulnerability-and-capacity-assessment-2001

Caring for The Most Vulnerable: What Can We Do?

- Improve ability to **identify location of vulnerable populations**, and include this information in municipal emergency operations plans
- Consult geriatricians, community health specialists and other experts in plan development to **understand best ways to support low-income, minority and at-risk populations**
- **Improve surveillance, communication and emergency response** during severe weather events – particularly for elderly and transients, who are historically hard to reach during those times
- **Enhance general supportive services** for the elderly, disabled and homeless
- If possible, provide vocational training, career development, employment and budgeting skills, and job placement for homeless to **enhance people's resiliency**
- Enhance immigration and citizenship services
- Enhance educational services

The needs of the homeless are often overlooked during extreme weather and emergency events.

Considering Vulnerable Populations in Climate Change Adaptation Planning

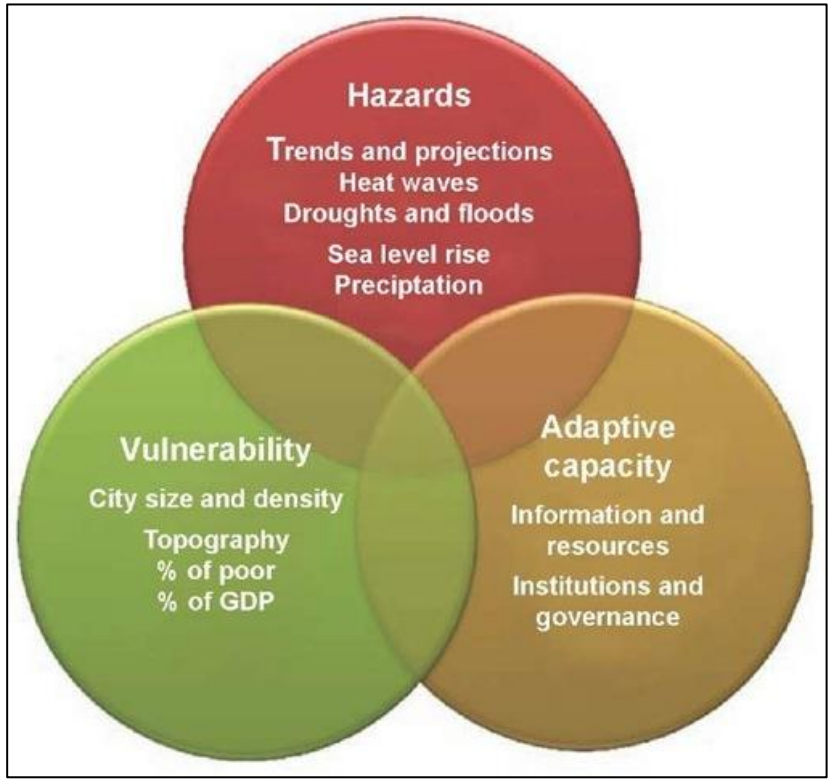
Considerations for Vulnerability Planning

- Determine “most vulnerable” population’s location
- Assess their capacity to recover from climate change-related events

“Most vulnerable” is sometimes misleading:

  - Not all seniors, youth, disabled or marginalized people are “vulnerable”
  - Some may be adept at responding

- Undertake risk management activities such as:
  - Population health assessments in partnership with public health officials
  - Public education and outreach
  - Creation of stronger social infrastructure



Urban climate change vulnerability and risk assessment framework.

Engaging The Public and Vulnerable Populations

Public Engagement Strategies

1.) Appropriate framing and awareness of audience:

Per an article in E Magazine, “messages need to be tailored to a specific medium and audience, using carefully researched metaphors, allusions, and examples that [**resonate** with that audience and] trigger a new way of thinking about the personal relevance of climate change.”

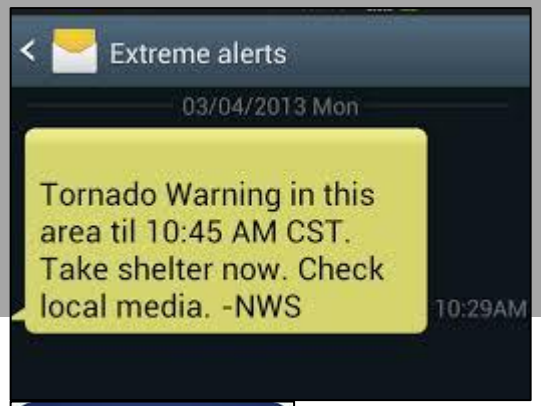
2.) Role models in positions of community leadership:

When residents perceive that municipal figures of authority are engaged in the very practices they themselves are being asked to adopt, it enhances the level of “buy-in”.

3.) Acknowledge cultural identity, traditional knowledge, heritage and worldviews of vulnerable populations:

The sense of belonging and connectedness to a social group plays a key role in the ability of vulnerable communities to cope with and recover from climate change impacts, and helps build resiliency.

Social Media and Public Engagement



Social media may:

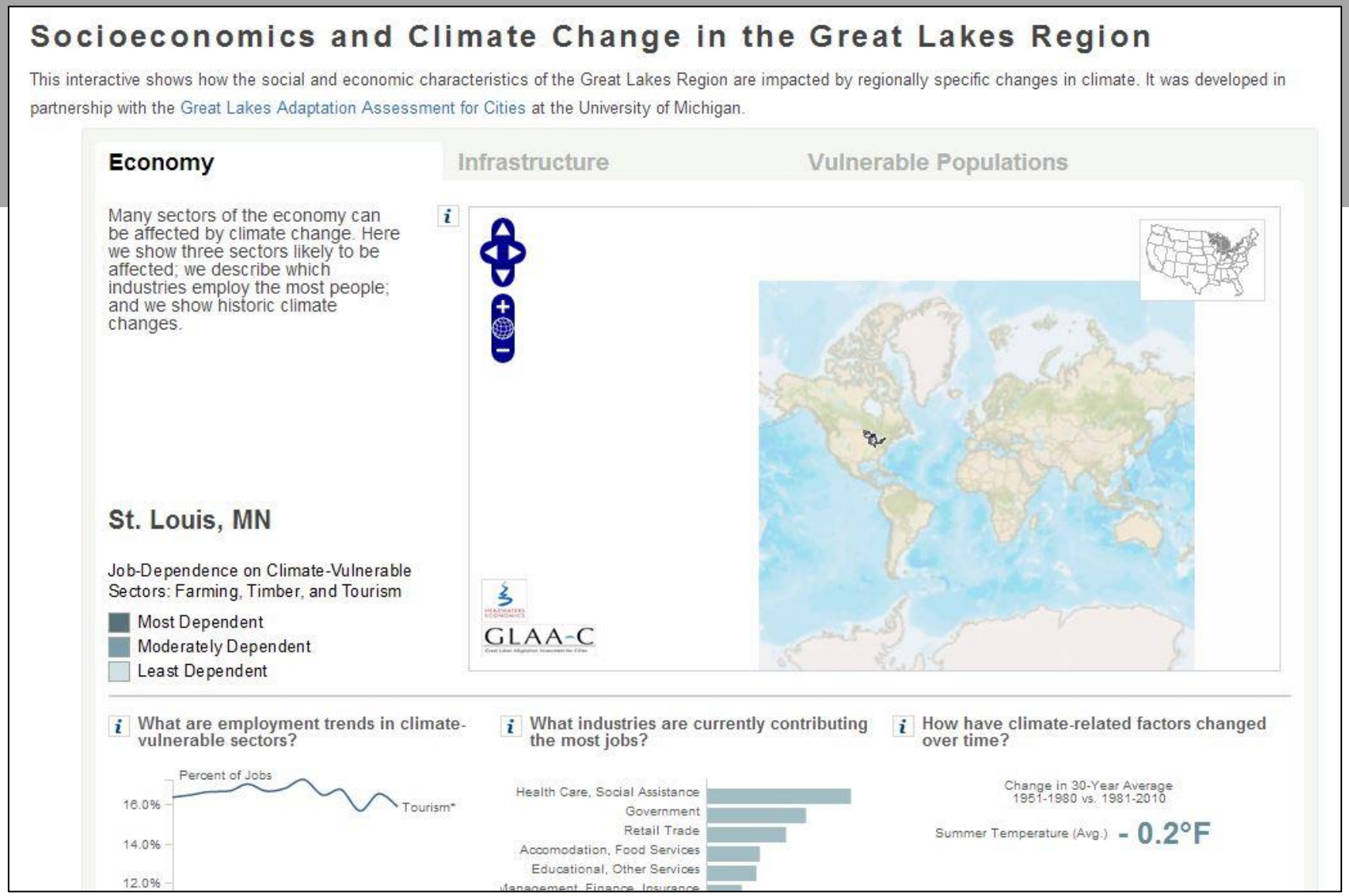
- Provide real-time access to events as they unfold, aiding in emergency communications
- Facilitate rapid dialogue across distances, generations and party lines; foster diversity
- Help translate scientific or complex information into more comprehensible nuggets
- Foster dialogue about contentious issues
- Give voice to local needs and help connect people with essential resources in their neighborhoods
- Strengthen social networks and promote self-organization
- Empower youth and renew cultural identities

The sense of 'belonging' and 'connectedness' stemming from social media may help reduce vulnerable populations' anxiety and uncertainty associated with climate change impacts, as well as improve the local responses through stronger networks, flexibility and self-organization.

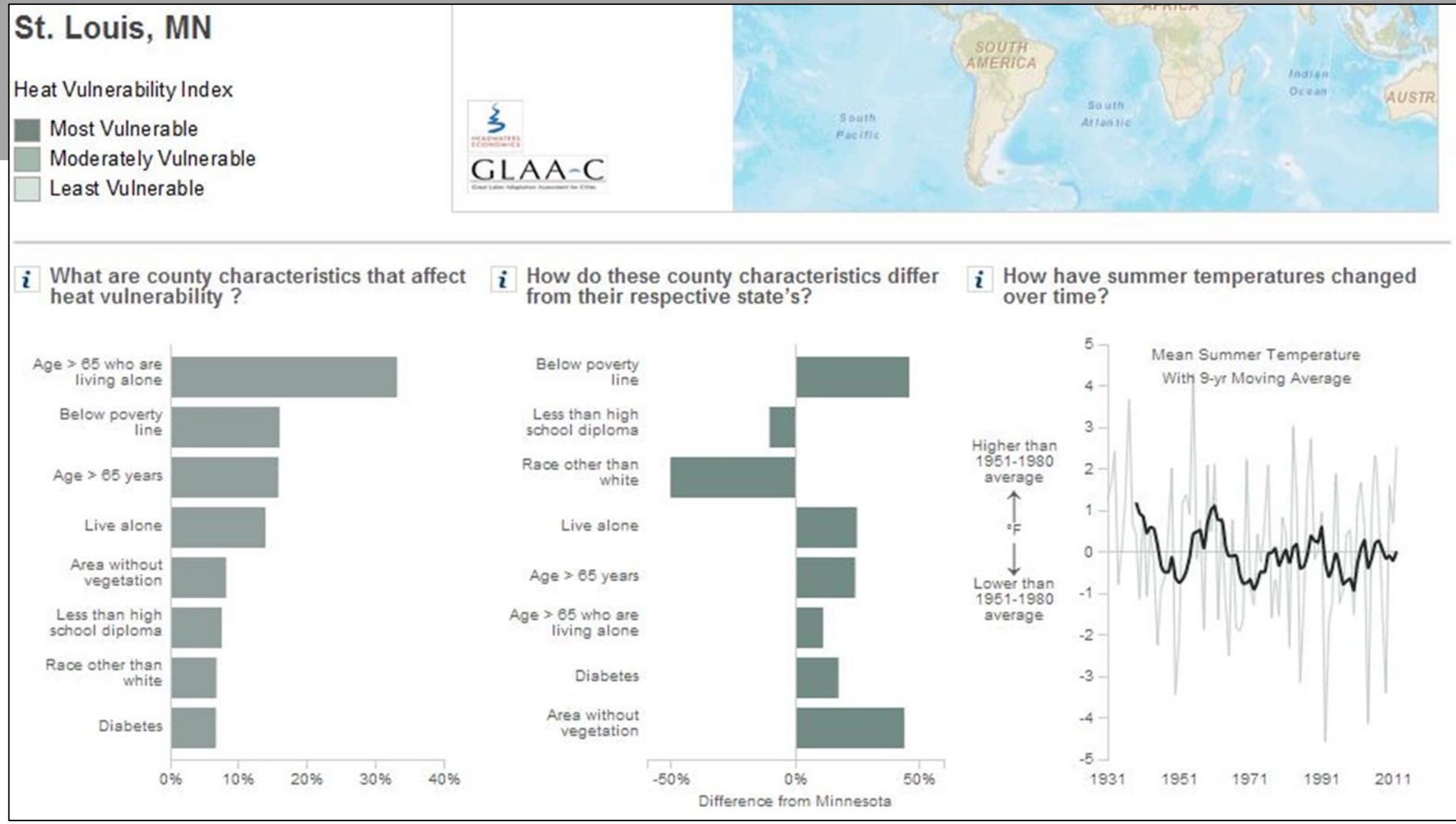
Tools, Case Studies and Resources

Mapping Tools

Developed by Headwaters Economics in partnership with the University of Michigan's Great Lakes Adaptation Assessment for Cities (GLAA-C), these maps show regionally-specific climate change impacts on economies, infrastructure and vulnerable populations.



Example



St. Louis-specific GLAA-C map

Building Resilience Against Climate Effects (BRACE)

BRACE is a funding-based tool offered by the US Centers for Disease Control and Prevention. It was used by the City of Chicago to compile the Cook County Climate Change and Public Health Action Plan

There are five sequential steps in the BRACE Framework (excerpted from http://www.cdc.gov/climateandhealth/BRACE.htm):

Step 1: Forecasting Climate Impacts and Assessing Vulnerabilities: identify the scope of the most likely climate impacts, the potential health outcomes associated with those, & the populations/locations vulnerable to these impacts;

Step 2: Projecting the Disease Burden: estimate the burden of health outcomes due to Climate Change;

Step 3: Assessing Public Health Interventions: identify suitable health interventions for health impacts of greatest concern;

Step 4: Developing and Implementing a Climate and Health Adaptation Plan to address health impacts, gaps in critical public health functions/services, and a plan for enhancing adaptive capacity in the jurisdiction.

Step 5: Evaluating Impact and Improving Quality of Activities– evaluate the processes used, determine the value of utilizing the framework and the value of climate and health activities undertaken.

Community Vulnerability Assessment Tool (CVAT)

- Uses geo-spatial analysis to inform vulnerability assessment
- Provides guidance for assessment of hazard-risk vulnerability (HRV) at municipal level
- Enhances emergency planning process
  - Offers 3 guidance questions:
    - Who are “most vulnerable”?
    - Where do they reside?
    - What is their capacity to respond or recover?
- Supports linking of environmental, social and economic data in coastal zone
- Support development of hazard mitigation strategy based on systematic evaluation of vulnerabilities
- Gives 18-step instruction on how to conduct vulnerability and capacity assessment
  - Provides questions for planner to consider during each step

CVAT Step by Step

Step 1 & 2: Assemble the Planning Team and set planning parameters

Step 3-6: Gather Relevant Information

Step 7 to 11: Define/Map high-risk areas and conduct vulnerability analysis

Step 12-16: Prioritization

Step 17: Identify Issues and Take Action

Step 18: Review/Update

First responders are an important part of your planning team.

Training tool for Rural Communities

MGT 338 Risk and Vulnerability Assessments for Rural Communities

-8 hours of instruction

-Basic components of risk and vulnerability assessment

RDPC™

Rural Domestic Preparedness Consortium

Cook County Case Study:
The Cook County Climate Change and Public Health Action Plan

In climate change, social factors will influence health and resiliency outcomes.

- Chicago context:
  - Cook County houses over 5 million people
  - 2nd most populous county in U.S.
  - Midwest will experience highest numbers of climate change-related illness and death (Greenough, 2001)
  - Needed a strategic plan to better equip and prepare public health officials

Developed a Public Health Action Plan with Northwestern University, in partnership with Physicians For Social Responsibility

Source citation: Cook County Climate Change and Public Health Action Plan,http://www.chicagopsr.org/PDFs/climatechangepublichealthplancookcounty.pdf

Cook County's Goals and Resources

Goals and Objectives

1. Examine predicted health outcomes stemming from climate change;
2. Identify risks and vulnerable populations;
3. Focus on planning, preparation and adaptation that can extend to Statewide level

Primary funding sources included:

- Northwestern University School of Engineering
- City of Evanston and City of Chicago Public Health Departments
- Board of Directors for Chicago PSR (Physicians for Social Responsibility)
- Sisyphus Family Foundation, as well as individual donors
- Additional support provided by the CDC's BRACE program.

Source citation: Cook County Climate Change and Public Health Action Plan, http://www.chicagopsr.org/PDFs/climatechangepublichealthplancookcounty.pdf

Focus Areas and Key Takeaways

Focus Areas:

- Extreme Weather
- Foodborne Illnesses
- Vector-Borne Diseases
- Water Quality, Quantity and Waterborne Illnesses
- Air Pollution and Allergens

Mitigation recommendations:

- Properly insulate homes and install energy-efficient fixtures
- Conserve water and retrofit flush/flow fixtures
- Reduce motor vehicle use
- Encourage walking, cycling and public transit
- Eat locally-grown food
- Promote healthier lifestyle

Adaptation recommendations:

- Develop climate models specific to Cook County;
- Identify and map vulnerable populations;
- Promote awareness climate change dangers and improve public communication on all focus areas;
- Improve extreme weather surveillance programs;
- Involve geriatricians, community health physicians, and homeless advocates to review emergency operations plans; improve health services during infectious disease outbreaks;
- Comprehensive messaging regarding refrigeration / need to discard food after power outages;
- Strive to eradicate homelessness;
- Develop climate adaptation plans for local water /wastewater utilities, with more resilient, ecologically-based water treatment infrastructure.

Source citation: Cook County Climate Change and Public Health Action Plan, http://www.chicagopsr.org/PDFs/climatechangepublichealthplancookcounty.pdf

Albany NY Case Study:

The Albany Climate Change Vulnerability Assessment and Adaptation Plan

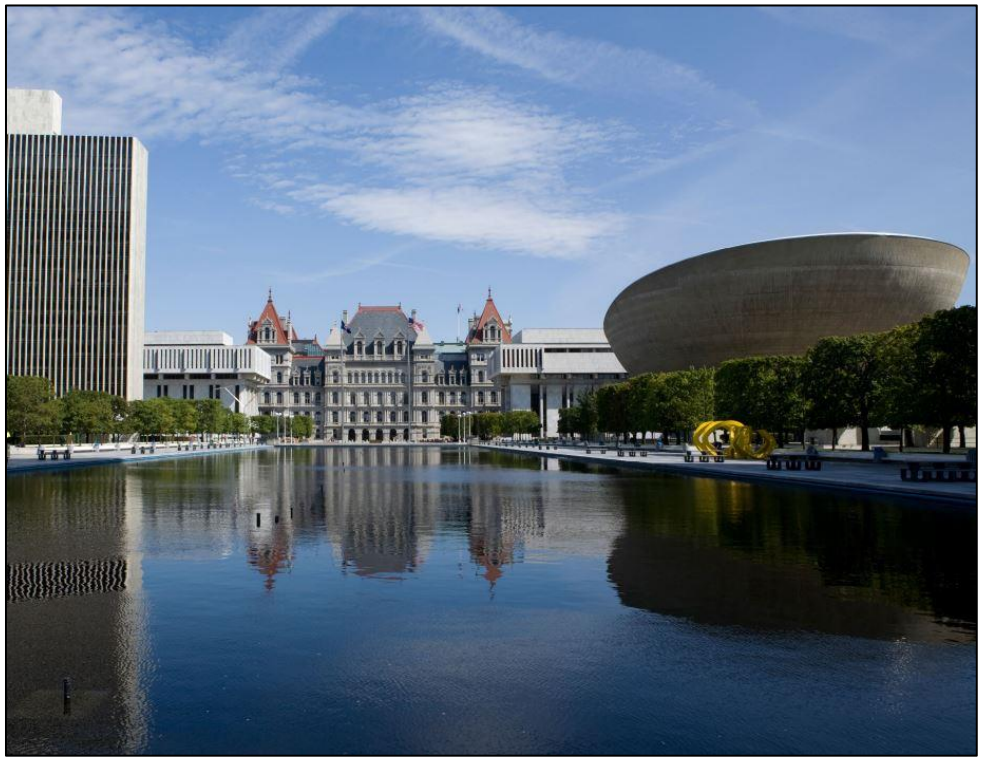
Albany's Climate Change Vulnerability Assessment and Climate Adaptation Plan builds off of the ClimAID Report by analyzing how climate change could affect the people, infrastructure and natural resources of Albany. The Plan sought to offer recommendations and strategies for improving the city's resilience and adaptive capacity.

Context:

- The City of Albany is home to 2,398 acres of open space
  - Parks and natural preserves account for 17 percent of the land area in Albany
- In Albany, climate change will likely lead to:
  - Increases in temperature, average annual precipitation frequency and severity
  - Sea level rise

Possible Local Impact:

- Stormwater system overwhelm, increased flooding
- Threats to public health
- Additional stress on already sensitive ecosystems



Source citation:
http://www.albany2030.org/files/Albany%20Vulnerability%20Assessment%20%26%20Adaptation%20Plan.pdf

Albany's Resources and Goals

Resources and Tools Used:

- The Albany County All-Hazard Mitigation Plan
- Historical documents/records
- Federal Hazard Maps
- Federal Emergency Management Agency's National Flood Insurance Program's detailed flood maps and studies
- Geographic Information Systems (GIS)
- Modeling Software - FEMA HAZUS-MH (earthquakes, hurricanes, wind, and floods)

Goals and Objectives

- Assess how climate change will affect the city's systems and sectors
- Provide recommendations and strategies on how to improve the city's resilience and adaptive capacity
- Provide a baseline understanding of the impacts of climate change
- Enable the city to incorporate these impacts into current and future planning endeavors.

In keeping with the concepts of *Albany 2030*, the city's comprehensive plan, the Climate Change Vulnerability Assessment and Adaptation Plan is designed to coordinate with other long-range planning efforts.

Focus Areas and Key Takeaways

Steps:

- Establish a Climate Profile (using mapping and modeling throughout the process)
- Identify systems and sectors to examine in the study
  - 3 systems were selected: society, infrastructure, and natural resources
  - 9 sectors: public health, property, transportation, critical facilities, energy, water and sewer, air quality, natural habitat, and urban forest

Lessons Learned:

- Incorporate climate impacts into current and future planning endeavors
- During assessment process, use a combination of best practices and lessons learned from climate adaptation and hazard mitigation efforts around the country
- Prioritize the areas of vulnerability and make recommendations on adaptation actions
- Identify an initial set of strategies that will help increase the city's resilience to climate change and natural hazards in general
- Lay out a blue print for future development in Albany

Massachusetts Schools Initiative

- Each school district has a designated school that acts as evacuation site in event of emergency;
- After identifying a need to protect vulnerable citizens during a heat event, the MA Health Department—in partnership with CDC's Climate-Ready States & Cities Initiative—is working with the state's Department of Education to secure funds to install air conditioning in these schools;
- These can then be used as cooling shelters during extreme heat events.

Next Cities Initiative Webinar

Next webinar:
Adaptation and Water, Wastewater and Stormwater
January 14, 2015 at 10:00am central/ 11:00am eastern

Please register at:
http://www.glslcities.org/mars.cfm#current web

Thank you for joining us!

Resources

Climate Change Adaptation and Health Equity
http://www.cleanairpartnership.org/files/Climate_Change_Adaptation_and_Health_Equity_Backgrounder.pdf
Developing Evidence-based health policy in a changing climate
http://src-online.ca/index.php/src/article/view/134/276
Exploring Health and Social Impacts of Climate Change in Toronto
http://www.toronto.ca/legdocs/mmis/2013/hl/bgrd/backgroundfile-62786.pdf
Climate Change Adaptation: Linkages with Social Policy
http://www.horizons.gc.ca/sites/default/files/Publication-alt-format/2010-0036-eng.pdf
Impacts of Climate Change on Public Health
http://glisaclimate.org/media/HRWC%20Public%20Health.pdf
Syndromic Surveillance System for Health-related Illnesses
http://www.cleanairpartnership.org/files/4%20Case%20Study.pdf
Adaptation to Climate Change in the Ontario Public Health Sector
http://pubmedcentralcanada.ca/pmcc/articles/PMC3418204/
List of Potential “Vulnerable Populations”, Appendix A of CVCA
https://www.ccadaptation.ca/en/component/k2/item/2671-community-wide-vulnerability-and-capacity-assessment-2001
Key Models of Hazard Assessment, Appendix D of CVCA
https://www.ccadaptation.ca/en/component/k2/item/2671-community-wide-vulnerability-and-capacity-assessment-2001

Resources (cont'd)

Minnesota Department of Health (MDH, 2010) Strategic Plan to Adapt to Climate Change
http://www.health.state.mn.us/divs/climatechange/docs/mdhspacc.pdf

•NYSERDA. "Responding to Climate Change in New York State: The ClimAID Integrated Assessment for Effective Climate Change Adaptation in New York State." Technical Report, 2011.
• Source citation: Cook County Climate Change and Public Health Action Plan, http://www.chicagopsr.org/PDFs/climatechangepublichealthplancookcounty.pdf
•Cook County Department of Public Health Annual Reports: http://www.cookcountypublichealth.org/publications/annual-reports.
•Centers for Disease Control and Prevention. "Extreme Weather Events." http://www.cdc.gov/climatechange/effects/extremeweather.htm