Climate Risk and Vulnerability at the Nexus of Equity, Health, Public Works, and Planning

Adaptation Webinar 3

June 5, 2020
Welcome

Kevin Burns, Mayor, City of Geneva
Chairman, Metropolitan Mayors Caucus Environment Committee and Energy Sub Committee
U.S. Climate Resilience Toolkit Speakers

Ned Gardiner, PhD  
Engagement Manager  
NOAA Climate Program Office &  
U.S. Climate Resilience Toolkit  
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Jim Fox  
Sr. Resilience Analyst  
NEMAC-Fernleaf & U.S. Climate Resilience Toolkit  
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Practical Guidance for Chicago Region Climate Planning Using the Steps to Resilience
Impacts of Greatest Concern

• Heat & Health
• Flooding & Homes
• Flooding & Infrastructure
• Flooding & Businesses
Can you accept the vulnerability and risk to your assets?
A quantifiable assessment of exposure, sensitivity, adaptive capacity, vulnerability, and risk.
Heat & Health

Climate Stressor: Temperature Variability and Change
Non-Climate Stressor: Blacktop (albedo)
Hazard: Heat Wave
Asset: People
Measurable Impact: Respiratory health

Vulnerability

- Sensitivity - Age of people, type of house
- Adaptive Capacity - Ability to cool structure or person
Extreme heat

- Heat island is closely linked to develop intensity and design
  - Impervious surfaces
  - Dark surfaces
- Occurs in the summer and the winter
People and Human Health/Extreme Heat

Levels of Sensitivity - Census Tracts

- **High** — High sensitive populations and high amount of developed land cover
- **Med** — High sensitive populations or high amount of developed land cover, not both
- **Low** — Low sensitive populations and low amount of developed land cover

Note: this is a preliminary analysis and should not be used for any official purposes
People and Human Health/Extreme Heat

Levels of Adaptive Capacity - Census Tracts

- **High** — High amount of tree canopy coverage
- **Med** — Moderate amount of tree canopy coverage
- **Low** — Low amount of tree canopy coverage

Note: this is a preliminary analysis and should not be used for any official purposes
People and Human Health/Extreme Heat

Levels of Vulnerability - Census Tracts

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>Low</th>
<th>Med</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>M</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Med</td>
<td>L</td>
<td>M</td>
<td>H</td>
</tr>
<tr>
<td>High</td>
<td>L</td>
<td>L</td>
<td>M</td>
</tr>
</tbody>
</table>

Note: this is a preliminary analysis and should not be used for any official purposes
Flooding & Homes

Climate Stressor: Extreme Precipitation
Non-Climate Stressor: Old Stormwater Systems
Hazard: Flooding
Asset: Homes
Measurable Impact: Flooded Basement

Vulnerability
- Sensitivity - Type of home and basement
- Adaptive Capacity - Ability to retrofit stormwater
Urban Flood Susceptibility Index (FSI)

- Topography
- Soils
- Land cover
- Reported flood damages
- Development patterns
The most vulnerable communities often have the least ability to adapt and recover.
Can you accept the vulnerability and risk that climate presents to your assets?
Please open mentimeter on your smart device or another tab

Go to menti.com

Enter the code 97 99 25
Chicago Region Climate Risk and Vulnerability Panel

Vernard Alsberry, Jr., Mayor, Village of Hazel Crest
Elena Grossman, MPH, University of IL BRACE
Katrina Thompson, Mayor, Village of Broadview
Sean O’Dell, PE, Director, Region V - American Public Works Association & Vice President & Region Manager - Baxter & Woodman, Inc
Brian Daly, Senior Planner, CMAP
Climate Risk and Vulnerability

Village of Hazel Crest

Vernard Alsberry, Jr.
Village President
Village of Hazel Crest
Hazel Crest & the Southland

Population - 13,935

Median Household income $54,196
(Cook County $59,426)*

2017 Data USA https://datausa.io/profile/geo/hazel-crest-il#economy
Climate change threatens the most vulnerable

Seniors

Extreme heat – threatens those without access to air conditioning
Infrastructure

Catch basin appears to be too high for the stormwater to drain to it. Over time, powerful rainstorms have eroded ground around catch basin.

Backyard Flooding
Village Drive Bridge
Creek Erosion

Orange caution net placed on decorative bridge that is not level due to the erosion of the creek.

Looking at the downstream end of the culvert at the discharge creek and erosion on the sides of the creek.
Trees & Open Space – a solution

Hazel Crest Open Lands

Woodland Flooding Mitigation Experiment

Planting Shumard Oak over Dry Well

Power-rake Compost Into Soil
Climate Change and Health in Illinois

Elena Grossman, MPH
BRACE-Illinois Program Director
UIC School of Public Health
Climate change and health in IL

Elena Grossman, MPH
BRACE-Illinois Program Director
UIC School of Public Health

Credit: NASA, Global temperatures in 2100 based on historic temperatures & GHG emissions
Impact of Climate Change on Human Health

- Heat-related illness and death, cardiovascular failure
- Injuries, fatalities, mental health impacts
- Asthma, cardiovascular disease
- Malaria, dengue, encephalitis, hantavirus, Rift Valley fever, Lyme disease, chikungunya, West Nile virus
- Respiratory allergies, asthma
- Forced migration, civil conflict, mental health impacts
- Extreme Heat
- Water and Food Supply Impacts
- Water Quality Impacts
- Cholera, cryptosporidiosis, campylobacter, leptospirosis, harmful algal blooms
- Changes in Vector Ecology
- Increasing Allergens
- Increasing CO2 Levels
- Severe Weather
- Air Pollution
- More Extreme Weather
- Rising Temperatures
- Rising Sea Levels
- Environmental Degradation
CLIMATE CHANGING HEALTH in Illinois

Environmental Changes
- Heat Waves
- Flooding
- Droughts
- Worsening Air Quality

Health Conditions
- Tick and Mosquito Diseases
- Injuries and Infections
- Respiratory Problems from Mold
- Heat Stroke and Exhaustion
- Contaminated Drinking Water
- Mental Health
- Worsening Allergies and Asthma

Carbon Pollution
- Coal Plants
- Factories
- Cars
- Community
Not everyone has the same opportunity to be healthy

Visit CountyHealthRankings.org
Where you live affects your health

Zip code better predictor of health than genetic code

Social determinants of health: how a few miles can be the difference for life expectancy

In Chicago, life expectancy can differ by as much as 18 years between just seven stops on the “L” between the Loop and Washington Park. In Philadelphia, the...
Life expectancy based on where you live

Virginia Commonwealth University’s Center on Society and Health: Mapping Life Expectancy
Comparison of highest and lowest life expectancies in LUMC’s service areas

2016 US life expectancy: 78.6

Illinois Department of Public Health, Division of Vital Records, 2016

Loyola University Medical Center Community Health Assessment 2019 https://www.loyolamedicine.org/sites/default/files/2019_chna_report_lumc.pdf
SocioNeeds Index: Another way zip codes indicate health challenges

<table>
<thead>
<tr>
<th>Zip Code</th>
<th>Community</th>
<th>Index</th>
<th>Rank</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>60426</td>
<td>Harvey</td>
<td>97.4</td>
<td>5</td>
<td>28,292</td>
</tr>
<tr>
<td>60411</td>
<td>Chicago Heights</td>
<td>91.1</td>
<td>5</td>
<td>57,257</td>
</tr>
<tr>
<td>60428</td>
<td>Markham</td>
<td>90.2</td>
<td>5</td>
<td>12,442</td>
</tr>
<tr>
<td>60409</td>
<td>Calumet City</td>
<td>88.0</td>
<td>5</td>
<td>36,212</td>
</tr>
<tr>
<td>60419</td>
<td>Dolton</td>
<td>85.7</td>
<td>5</td>
<td>21,810</td>
</tr>
<tr>
<td>60429</td>
<td><strong>Hazel Crest</strong></td>
<td>77.2</td>
<td>4</td>
<td>15,461</td>
</tr>
<tr>
<td>60466</td>
<td>Park Forest</td>
<td>74.3</td>
<td>4</td>
<td>21,561</td>
</tr>
<tr>
<td>60425</td>
<td>Glenwood</td>
<td>66.8</td>
<td>4</td>
<td>9,025</td>
</tr>
</tbody>
</table>
Weather Fatalities 2018

http://www.nws.noaa.gov/om/hazstats.shtml
## Clinical spectrum of heat stress illness

<table>
<thead>
<tr>
<th>Syndrome</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat rash</td>
<td>Erythematous papules or macules</td>
</tr>
<tr>
<td>Heat cramps</td>
<td>Muscle cramps</td>
</tr>
<tr>
<td>Heat exhaustion</td>
<td>Elevated temperature, warm/hot skin, sweating, lucid</td>
</tr>
<tr>
<td>Heat syncope</td>
<td>Fainting due to heat and dehydration</td>
</tr>
<tr>
<td>Heat stroke</td>
<td>High temperature (&gt;103 F)</td>
</tr>
<tr>
<td></td>
<td><em>Altered mental status</em></td>
</tr>
<tr>
<td></td>
<td>High fatality rate</td>
</tr>
<tr>
<td></td>
<td>Persistent cognitive deficits in survivors</td>
</tr>
</tbody>
</table>
Urban Heat Island Effect

How the Heat Island Phenomenon occurs:

- Heat of vaporization
- Temperature goes down
- Sunlight
- Temperature increase
- Heat from vehicles
- Heat from the road surface
- Temperature increase
- Anthropic heat
- Temperature increase
- Heat from the building surface
- Temperature goes down
- Heat of vaporization
- Air conditioners
- Temperature goes down
- Rivers
FLOODS
Public Health Implications from Flood

- Mold; respiratory health
- Waterborne diseases
- Injuries
- Property damage
- Mental health (stress of event, property damage, displacement)

Damage in a home from floods in Lake County, IL July 2017
~70% of waterborne disease outbreaks in US preceded by precipitation events, 1948-1994

Curriero et al. 2001
RESPIRATORY HEALTH
More allergens and longer allergy seasons

Change in length of pollen season:
- Decrease
- Increase
- 1 day
More ozone pollution

NOx + VOC + Heat & Sunlight = Ozone

Ground-level or “bad” ozone is not emitted directly into the air, but is created by chemical reactions between NOx and VOCs in the presence of heat & sunlight.

Emissions from industrial facilities and electric utilities, motor vehicle exhaust, gasoline vapors, and chemical solvents are some of the major sources of oxides of nitrogen (NOx) and volatile organic compounds (VOC).
Vectorborne Diseases
Changing geographic ranges

https://www.cdc.gov/lyme/datasurveillance/index.html
Lyme Disease incidence in Illinois, Confirmed cases/100,000 2005-2015

https://www.cdc.gov/lyme/stats/tables.html
<table>
<thead>
<tr>
<th>Conditions</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher temperatures in winter</td>
<td>• More suitable for ticks to survive</td>
</tr>
<tr>
<td>Higher temperatures</td>
<td>• Increase tick development and hatching rates</td>
</tr>
<tr>
<td></td>
<td>• Accelerate the mosquito lifecycle, increase mosquito biting rates, decrease the time needed for a blood-fed mosquito to be able to pass on the virus</td>
</tr>
<tr>
<td>Increase in humidity and moisture</td>
<td>• Increase tick survival</td>
</tr>
<tr>
<td>Increased precipitation</td>
<td>• More aquatic breeding sites for mosquitoes</td>
</tr>
<tr>
<td>Higher temperatures in spring, summer, and fall</td>
<td>• Accelerates tick lifecycle, which increases ticks’ survival to reproduce</td>
</tr>
</tbody>
</table>
MENTAL HEALTH
Mental Health: A concern after extreme weather events

- A study of 815 people impacted by Katrina

<table>
<thead>
<tr>
<th>Condition</th>
<th>5-8 months after Katrina</th>
<th>1 year after Katrina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post Disaster Mental Disorder</td>
<td>14.9%</td>
<td>20.9%</td>
</tr>
<tr>
<td>Serious mental illness</td>
<td>10.9%</td>
<td>14%</td>
</tr>
<tr>
<td>Suicidal Ideation</td>
<td>2.8%</td>
<td>6.4%</td>
</tr>
<tr>
<td>Suicidal Plans</td>
<td>1%</td>
<td>5%</td>
</tr>
</tbody>
</table>

- Common symptoms include the inability to stop thinking about the hurricane, nightmares and emotional numbness.

- Equal opportunity disaster

Kessler et al, 2008
NEW ORLEANS — Brandi Wagner thought she had survived Hurricane Katrina. She hung tough while the storm’s 170-mph winds pummeled her home, and powered through two months of sleeping in a sweltering camper outside the city with her boyfriend’s mother. It was later, after the storm waters had receded and Wagner went back to New Orleans to rebuild her home and her life that she fell
Baseline health indicators, without climate change exacerbating them

HAZEL CREST

• Stroke Mortality Rate
  • Healthy People 2020 goal: 34.8/100,000
  • South region rate: 40.1
  • Hazel Crest: 67.8

• ED visits for asthma: 76.9/10,000 (4th highest in U of C hospital Service area)

• One of Highest rates of ED visits due to diabetes in service area

• ED visits for asthma for children and youth under 18: 164.8 per 10,000 (2nd highest in service area)

BROADVIEW

Age-adjusted mental health emergency department visit rates per 10,000 in Cook County, Illinois (Adults)


Illinois COMPdata, 2015-2017, Analysis conducted by Conduent Healthy Communities Institute

Loyola University Medical Center Community Health Assessment 2019 https://www.loyolamedicine.org/sites/default/files/2019_chna_report_lumc.pdf
What Can We Do About This?

- Tree canopies
- Green spaces
- Green roofs
- White roofs
- Complete streets
- Rain gardens
- Bioswales
- Water plazas/Watersquares
- “No idling” policies
- Develop a Heat Alert Plan
- Develop an outreach plan to vulnerable populations

Air quality
- Physical activity
- Protection from heat
- Mental health
- Social connectedness
- Obesity and diabetes
- CO2 pollution
- Need for A/C
- Asthma triggers (ozone)
- Storm water runoff
Thank you! Questions?

Elena Grossman
UIC School of Public Health
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Please open mentimeter on your smart device or another tab.

Go to menti.com

Enter the code 97 99 25
Village of Broadview

Population – 7,982

Median Household income $53,100
(Cook County $59,426)*

2017 Data USA https://datausa.io/profile/geo/hazel-crest-il#economy
Most vulnerable residents – Youths

Air pollution

Asthma & Respiratory Health
Social Cohension

Nelson Mendala stated that “It is ordinary people that make the work a special place”

Advocacy
Sustainability
Implementation
Recreation for All
Make sure everyone enjoys a quality of life!
Public Works – Operations & Infrastructure

Sean O’Dell, P.E.
Director, Region V - American Public Works Association
Vice President Water & Mokena Region Manager
Baxter & Woodman
Public Works Challenges

• Climate change is increasing the number & severity of public works emergencies
• More pressure on public works staff, equipment, infrastructure, systems
• Aging infrastructure and workforce
• Many unfunded regulatory mandates

Bright Side:
Public Works Loves to Adapt
Public Works Solves Problems
Public Works Will Keep us Safe
3 things

• Where is Public Works today?
• Where will Public Works be tomorrow?
• What Actions can we take today?
Public Works Today

• Reactive Mode - Failing Infrastructure & Squeaky Wheel
• Improving Communications & Managing Expectations
• Making Energy Efficiency a Priority
• Risk, Resilience & Vulnerability are Making a Comeback
• Rates & Affordability
Public Works Tomorrow

• Proactive Mode
• Comprehensive Planning & Prioritization
  • Water, Wastewater, Stormwater, Energy, Transportation, Fleet, Facilities
• Improved Asset Management & Assessment
• Regionalization of Utilities
• Data Driven Decisions
• Automation Improved Operations
• Quicker to Innovate
Call to Action

• Regional Planners – Arm us with Data, Benefits & Comp plans
• Elected Officials – Set the Priorities & Give the Resources
• Public Works – Listen to Leaders & Execute on the Vision
• Engineers – Promote & Innovate Sustainable Solutions
• Innovators & VC – Invest in Sustainable Tech & Bring Ideas to all Levels
• Regulators – Understand the Conflicting Priorities
• Everyone – Educate Themselves & Communicate with the Public
Climate Risk and Vulnerability

Planning for Climate risk in the Chicago region

Brian Daly
Senior Planner
CMAP
Planning for Climate risk in the Chicago region

MMC Webinar: Climate Risk and Vulnerability
June 5, 2020
Our region today
Integrating Climate Science

• Three-year project

• Funded by NOAA’s Sectoral Applications Research Program
Vulnerability Analysis

Key Findings

Climate and Natural Hazards

Vulnerability and Risk Assessment

1. Critical Infrastructure

2. Social Vulnerability

3. Economic Impacts
Flood damages

~$1 billion in damages

+70% outside of 100-year floodplain
Based on the relationship between reported flood locations and the following factors:

- Combined Sewer Service Area
- Elevation and topography
- Impervious Cover
- Age of Development
- Precipitation

Urban flood susceptibility
Vulnerability Analysis

Flood Impacts

Wilmington Downtown - Urban Flood Susceptibility Index

- Wilmington Downtown Study Area
- Major Road
- Railroad
- Water
- Open Space

**FSI score**

- High: 10
- Low: 1
Vulnerability Analysis
Heat Impacts

Land Surface Temperature
High: 117
Low: 63

- City of Des Plaines
- Unincorporated Areas
- County Boundary
- Open Space
- Cemetery
- Water

Chicago Metropolitan Agency for Planning, 2018.
Vulnerability Analysis

Social Vulnerability

- Economically Disconnected Areas
- Urban FSI** by Catchment (mean)
- City of Des Plaines
- Unincorporated Areas
- Open Space
- Cemetery
- Water

* Based on ACS 2014 tracts.
** Variables in Urban FSI (Flood Susceptibility Index): Age of First Development, Combined Sewer Service Areas, Base Flood Elevation, and Impervious Cover.

Chicago Metropolitan Agency for Planning, 2018
Guidebook

Regional Climate Overview

Data Analysis Guide

Capacity Building

Making the Case
Lessons learned

Work with trusted partners to understand data

Frame uncertainty as part of planning

There is enough data to be informative

Be flexible
Water Demand Forecast
Forecasted demand exceeds groundwater supplies

Projected changes in water demand by water source, 2011-50

- Lake Michigan: +33%
- Shallow Aquifer: +35%
- Sandstone Aquifer: +14%
- Fox River: +20%
- Kankakee River: +19%
- Other River: +9%

Source: CMAP ON TO 2050 Regional Water Demand Forecast.
Brian Daly
bdaly@cmap.illinois.gov

https://www.cmap.illinois.gov/programs/sustainability/climate-science

https://datahub.cmap.illinois.gov/
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Enter the code 97 99 25
“We will not allow the actions of the past to dictate our future and we commit to leveraging our network and resources to promote justice, equity, diversity, and inclusion in the climate adaptation field and beyond.”
QUESTIONS?

Please join us for the last climate adaptation webinar

4. Adaptation Planning & Prioritization Workshop - June 12, 2020, 1:00 – 3:00 pm

https://mayorscaucus.org/climatewebinars/
Chicago Metropolitan Regional Climate Action

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