Join us for the inaugural Resilience Summit
Climate Risk, Real Estate, and Land Use
September 18 | Washington, DC

Learn from cutting edge research on climate risk and resilience
Engage with “doers” from across the industry
See new strategies to assess climate risk
Tour innovative projects designed to address climate threats, including new waterfront developments in Washington, DC

Register at uli.org/2019resiliencesummit
Don’t Miss This Event at the 2019 ULI Fall Meeting in Washington, DC!

Beating the Heat: How Developers and Cities Are Mitigating Heat Island Impacts
September 20 | 10:00 a.m.

Register at fall.uli.org
Prices increase after August 16!
Extreme Heat Resilience and Real Estate

Understanding and Addressing Impacts to Urban Environments

AUGUST 7, 2019
Introduction – It’s Getting Warmer

Source: Annual average temperatures for GLOBE from 1850-2018 using data from UK Met Office. https://showyourstripes.info
Introduction – It’s Getting Warmer
Today’s Presenters

Jack Davis
RE Tech Advisors
Portland, OR

Ladd Keith
University of Arizona
Tucson, AZ

Kizzy Charles-Guzman
City of New York
New York, NY

Johnny Campbell
Sundance Square
Fort Worth, TX
Introduction
Scorched – Extreme Heat and Real Estate

- Now available at https://uli.org/extremeheat

- Report details:
  - The Science and the Impacts
  - Implications and Opportunities for the Real Estate Sector
  - The Extreme Heat Policy Landscape
  - Case Studies and Innovations

- With support from:
“We’re facing scenarios where summers are 5°F hotter with prolonged heat waves every other year. **What types of properties will be attractive?** Where will people want to live….fill their leisure time?.”

Edward Dixon
Director, Sustainability Insights
LandSec
Introduction
A framework for today’s discussion

Science
City
Project
Extreme Heat: Causes, Impacts, and Addressing the Risk

Ladd Keith, Ph.D.
Assistant Professor, Planning
Chair, Sustainable Built Environments

@LaddKeith
Extreme Heat

A Relevant and Increasing Climate Risk

128 million people in U.S. under excessive-heat warnings during July 2019 heatwave.
Extreme Heat Causes

Urban Heat Island (UHI)

- Land use and cover change
- Urban form (building height, density, and arrangement)
- Building materials
- Vegetation and humidity
- Building equipment
- Waste heat emissions
- Air pollution

(U.S. EPA)
Extreme Heat Causes

Urban Heat Island (UHI)

- Many cities can have a UHI difference between urban and rural areas of 10°F
- UHI can be as much as 22°F on hottest days

We can use our understanding of UHI to reduce it and increase resilience to it.
Extreme Heat Causes

Climate Change

- Increase in global average temperatures
- Increase in duration, frequency, and extremes of heatwaves
- Faster increase in night-time temperatures

(U.S. EPA)
Extreme Heat Causes

Climate Change Projections

- Average annual temperature has already increased **1.2°F** in last three decades
- Projected to increase **3°F to 12°F** by 2100 depending on emission reductions

We can avoid the worst-case scenarios by drastically reducing greenhouse gas emissions now.

(U.S. National Climate Assessment)
Extreme Heat Impacts

Impacts

Impacts of extreme heat vary by location:

- Public health and quality of life
- Economic
- Energy and water usage
- Infrastructure and urban systems
- Ecology and landscapes
- Sustainable development efforts
Extreme Heat Impacts

Before the heatwave...

...and after the heatwave
Extreme Heat Impacts

Challenges

• The “invisible” climate risk
• Compounding risk
• Difficult to measure impacts
• Most vulnerable at highest risk
• Lack of governance structure
• Urban heat island maps and other heat data sources not widely available
• Design and policy solutions are context-specific
• Heat is the climate risk with the least resources available
Addressing Extreme Heat

Opportunities

• Rapidly growing interdisciplinary research area
• Improving understanding of:
  • Urban heat island mapping
  • Ambient air temperature modelling
  • Context-specific heat reduction strategies
  • Public health prevention and response strategies
  • Heat governance
Addressing Extreme Heat

Opportunities

• Many successful historic and new heat-adapted projects
• Emerging extreme heat mitigation and adaptation strategies

We can design heat-adapted sites and plan cities to reduce both UHI and greenhouse gas emissions.
Thank you

Ladd Keith, Ph.D.
ladd@arizona.edu

@LaddKeith
NYC HEAT RESILIENCY

Kizzy Charles-Guzman
Deputy Director
NYC Mayor’s Office of Resiliency

Urban Land Institute Extreme Heat Webinar
NYC'S CLIMATE HAZARDS

Coastal Storms: Flooding/Wind

Sea Level Rise: Tidal Flooding

Precipitation: Inland Flooding

Extreme Temperatures: Heat Waves/Cold Snaps

Groundwater Table Rise: Coastal Flooding
STORMS ARE NOT THE ONLY CLIMATE HAZARD WE MUST PREPARE FOR

TEMPERATURE

# of days above 90°F TRIPLE by 2050s

NYC SUMMERS LIKE BIRMINGHAM, ALABAMA
HEAT EXPOSURE IS DEADLY, AND PREVENTABLE

- 1995 Chicago/Midwest: 750 deaths
- 2003, Europe: >30,000 deaths
- 2013 NYC: ~160 deaths
- 2015 India: 2,500 deaths
- 2015 Tokyo ~119 deaths
- 2018 Canada ~100 deaths
- 2018 Japan ~110 deaths, 30,000 hospitalized
HEAT EXPOSURE IS DEADLY, AND PREVENTABLE

- Indoor temperatures can be 20°F higher than outdoor temperatures without AC.
- NYC heat-mortality rates are associated with poverty and poor housing quality.
- ~88% prevalence of residential AC in NYC.
- On average, each summer in NYC there are:
  - 450 heat-related ED visits
  - 150 heat-related hospital admissions
  - 13 heat-stroke deaths
  - ~115 excess deaths from heat-related causes
RISKS VARY BY NEIGHBORHOOD

3.4 million people live in high heat vulnerability census tracts.
LAUNCHED COOL NEIGHBORHOODS NYC IN JUNE OF 2017

A comprehensive strategy informed by health & climate data to achieve climate equity goals

Design principles:

- Protect and prepare New Yorkers
- Focus on vulnerable populations
- Focus on underserved communities
- Enhance quality of life
- Promote community cohesion
- Utilize existing networks and resources
- Disseminate climate information
$100M+ INVESTMENT IN TARGETED TREE PLANTING IN KEY NEIGHBORHOODS
STRATEGIC IMPLEMENTATION OF NYC COOL ROOFS

- Over 10 million sq.ft. of white roofs to date
- Reduce building energy use and waste-heat from A/C.
- Reduce local temperature via clusters of light-colored surfaces.
- In 2018, 73% of Cool Roofs installed were in the two highest heat vulnerability tiers
STRATEGIC IMPLEMENTATION OF NYC COOL ROOFS

NYCHA – Albany Houses, Crown Heights, Brooklyn - 2016

NYCHA – Albany Houses after roof coating in 2018
WE NEED TO DO MORE TO ADDRESS INDOOR HEAT RISK

Failure to update building regulations could triple heatwave deaths by 2040

The government has rejected advice to approve the new regulations that ensure homes, hospitals and schools do not overheat as the number of deadly heatwaves rises with climate change.

Eight elderly Florida nursing home residents die after Hurricane Irma cuts off facility's air conditioning.
BUILDINGS ARE AN IMPORTANT PART OF THE PROBLEM

- Over 90% of the one million buildings that exist in NYC today will still exist in 2050.
- The median age of residential buildings is ~90 years old.
- Access to AC and proper ventilation vary greatly from building to building.
- Need to ensure existing buildings are adapted to a future with more extreme heat days, and that they do not contribute to heat pollution.

Source: Brian Vant-Hull, Prathap Ramamurthy, City College
DESIGN PROJECTS TO WITHSTAND CLIMATE CONDITIONS PROJECTED FOR THE END OF THEIR USEFUL LIFE

- Evaluate projected heat impacts on systems and materials.
- Design building envelopes to meet higher insulation and fenestration requirements to improve energy efficiency.
- Select building materials that help reduce building heat gain and energy consumption.
- Consider how climate hazards impact service or resource dependencies between the project in design and other facilities or service utility providers.
- Consider risk from coincident events to specific projects (e.g. power outage + heat wave)
- Prioritize cooling and passive survivability investments in projects entailing social infrastructure (residential, adult care, supportive and assisted living housing, recreational & educational facilities).
DESIGN BASED ON FORWARD-LOOKING CLIMATE DATA

Select strategies to reduce heat impacts. For example:

- Increase the solar reflectance of surfaces by using light-colored pavement, coatings and materials, targeting at least 50% of the non-structure areas of facility sites.
- Increase shading by planting trees or other vegetation, in combination with porous pavements, targeting at least 50% of the non-structure areas of facility sites.
- Select green/blue roofs and/or other landscape elements that maximize cooling.
- Reduce or capture waste heat from AC and mechanical systems.

Helpful resource: NYC CLIMATE RESILIENCY DESIGN GUIDELINES
https://www1.nyc.gov/assets/orr/pdf/NYC_Climat...
OTHER HELPFUL RESOURCES

1. NYC Green Codes Task Force
2. Building Resiliency Task Force
4. Strategies for Cooling Singapore 2017
THANK YOU

Kizzy Charles-Guzman, Deputy Director, Social Resiliency
NYC Mayor’s Office of Resiliency

KGUZMAN@CITYHALL.NYC.GOV
### Shade Comparison - post-development

<table>
<thead>
<tr>
<th>Season</th>
<th>Daily Morning Average (~sq. ft)</th>
<th>Daily Afternoon Average (~sq. ft)</th>
<th>Seasonal Average (~sq. ft)</th>
<th>Acres (Acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>23,600</td>
<td>42,480</td>
<td>33,040</td>
<td>0.7584</td>
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<tr>
<td>Winter</td>
<td>25,360</td>
<td>52,560</td>
<td>38,960</td>
<td>0.8943</td>
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<tr>
<td><strong>Total Average (Fall + Winter)</strong></td>
<td><strong>25,960</strong></td>
<td><strong>58,040</strong></td>
<td><strong>36,000</strong></td>
<td><strong>0.8264</strong></td>
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<td>Spring</td>
<td>25,670</td>
<td>30,030</td>
<td>27,850</td>
<td>0.6393</td>
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<tr>
<td>Summer</td>
<td>24,930</td>
<td>26,860</td>
<td>25,895</td>
<td>0.5944</td>
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<tr>
<td><strong>Total Average (Spring + Summer)</strong></td>
<td><strong>25,400</strong></td>
<td><strong>57,890</strong></td>
<td><strong>26,873</strong></td>
<td><strong>0.6169</strong></td>
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### Shade Comparison - pre-development

<table>
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<th>Season</th>
<th>Daily Morning Average (~sq. ft)</th>
<th>Daily Afternoon Average (~sq. ft)</th>
<th>Seasonal Average (~sq. ft)</th>
<th>Acres (Acres)</th>
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<tr>
<td>Fall</td>
<td>12,530</td>
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<td><strong>Total Average (Fall + Winter)</strong></td>
<td><strong>15,210</strong></td>
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<td><strong>0.3593</strong></td>
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<tr>
<td>Spring</td>
<td>7,640</td>
<td>10,550</td>
<td>9,095</td>
<td>0.2088</td>
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<td>Summer</td>
<td>5,880</td>
<td>8,640</td>
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<td><strong>Total Average (Spring + Summer)</strong></td>
<td><strong>11,520</strong></td>
<td><strong>19,190</strong></td>
<td><strong>8,178</strong></td>
<td><strong>0.1877</strong></td>
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Parting Thought

“We need to continue to make buildings as energy efficient as possible for operational and climate change purposes, but also because the more inefficient buildings are, the more heat they emit.”

Patrick Hamilton
Director, Global Change Initiatives
Science Museum of Minnesota
Thank you!