ADAPTATION IMPLEMENTATION: RESEARCH TO IMPACT IN THREE SECTORS

June 24
Adaptation in the Great Lakes Region Conference
Research to Action: Themes

- Collateral Benefits
- Business Case
- Humanitarian Issue
CHICAGO CLIMATE ACTION PLAN
FIVE STRATEGIES

Co-Benefits: Improved Quality of Life

- Addressing the Challenge of Climate Change
  - Energy Efficient Buildings: 8 Actions
  - Clean & Renewable Energy Sources: 5 Actions
  - Improved Transportation Options: 10 Actions
  - Reduced Waste & Industrial Pollution: 3 Actions
  - Preparation: 9 Actions

= 35 Ways to Ensure a Resilient City
Temperature: A warmer Chicago

Chicago Metropolitan Area Annual Average Temperatures
Observations and projections under multiple emissions scenarios

Higher Emissions: 31 days

Projected number of 100-degree days per year in Chicago

Lower Emissions: 8 days
Health: Increasing heat-related risks

Chicago Metropolitan Area Heat-Related Deaths
Observations and projections under multiple emissions scenarios

Source: Hayhoe et al. Journal of Great Lakes Research, 2010
Climate Matters: Emergency Services

More heat emergencies... More storms... More fires

Increased demand on first responders
Impacts of Chicago’s Changing Climate

Midwest Seasonal Precipitation Events
Projected under high emissions

<table>
<thead>
<tr>
<th></th>
<th>2010-2039</th>
<th>2040-2069</th>
<th>2070-2099</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winters and Springs</td>
<td>![Map]</td>
<td>![Map]</td>
<td>![Map]</td>
</tr>
<tr>
<td>Summers</td>
<td>![Map]</td>
<td>![Map]</td>
<td>![Map]</td>
</tr>
</tbody>
</table>

% changes relative to a 1961-1990 average

Climate Matters: Extreme Precipitation

More rain when it is not needed, less when it is needed

Combined sewer overflows and swim bans
Economic Risk of Climate Impacts

Avg. additional annual cost in 2007 dollars by climate driver and period

Chart source: Oliver Wyman, Corporate Risk Case Study, 2008.
Mitigation-Adaptation Overlap

**Mitigation**
- Improve residential, commercial, and industrial energy efficiency
- International standard for Chicago Energy Efficiency Code
- Required green commercial/residential renovations
- Expand appliance trade-in programs
- Improve water efficiency in buildings
- Increase trees and rooftop gardens
- Promote no or low cost mitigation actions to public
- Procure renewable electricity generation
- Upgrade 21 Illinois power plants
- Implement 2001 Energy Plan to expand distributed generation and other projects
- Boost power generation efficiency standards
- Household-scale renewable power and solar domestic hot water
- Invest in transit
- Provide incentives for transit use
- Plan and design around transit hubs
- Increase car sharing
- Increase walking and bike trips
- Increase vehicle alternative fuel use
- Improve fleet energy efficiency
- Advocate for higher federal fuel efficiency standards
- Foster more efficient freight movement
- Support intercity high-speed rail plan
- Reduce, reuse, recycle
- Promote alternative refrigerants
- Manage stormwater with Green Infrastructure

**Adaptation**
- Innovative cooling strategies
- Urban Heat Island reduction
- Energy reduction program
- City Tree Fund
- Thermal environment map
- Flexible labor agreements
- High reflectivity pavement
- Citywide storm water management plan
- Private sector green roofs
- Performance-based landscape ordinance
- Green alley design
- “Single-lot” storm water ordinance
- Energy resource management plan
- City building natural ventilation
- Improved recommended plant list
- Urban forest management plan
- Increased public education
- Climate change DSS in planning
- Benchmarking against other cities
- Future climate benchmarking against other cities
- Climate sensitive procurement
- City-wide climate change design
- City heat response plan
- Ozone response activities
- Alternate school schedules
- Temperature trigger studies
- Indoor air quality evaluation
- MWMD watershed studies
- Water quality testing
- Permeable paving requirements
- Catch basin retrofits
- City-operated mosquito control
- Power vulnerability study
- Water pricing strategy
- Future-climate adapted City fleet
- Utility burial for street/traffic lighting
- Utility trenches
- Urban wetland management plan
- Ecosystem diversity index
- Emergency response planning and coordination
- Extended beach/boating season
- Restaurant and food supply research
Adaptation Resources

www.chicagoclimateaction.org
## CCAP Adaptation Evolution

<table>
<thead>
<tr>
<th>Year</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>• Understood the climate science: Assess climate impacts</td>
</tr>
<tr>
<td></td>
<td>• Assessed economic risk: Project City cost of no action at -$2.54B in high-emissions</td>
</tr>
<tr>
<td></td>
<td>• Developed adaptation action framework: Prioritize actions by risk &amp; timing</td>
</tr>
<tr>
<td>2008</td>
<td>• Created 5 climate impacts working groups: 21 departments &amp; agencies create 39 “Tactics” for 5 groups</td>
</tr>
<tr>
<td></td>
<td>• Launched CCAP: Mayor, September</td>
</tr>
<tr>
<td>2009</td>
<td>• Created CCAP department work plans: Departments commit to adaptation actions through work plans</td>
</tr>
<tr>
<td>2010</td>
<td>• Defined adaptation targets: People, Natural Environment, Built Environment</td>
</tr>
<tr>
<td></td>
<td>• Hosting “Lessons Learned” meetings: Improve responses to extreme weather events</td>
</tr>
<tr>
<td></td>
<td>• Forming Adaptation Advisory Group: Will provide guidance and oversight</td>
</tr>
</tbody>
</table>

Protect the city and its people by preparing for climate change
Business is Struggling to Address Corporate Responsibility Issues

What Business Should Do

Current Performance

Global | France | Germany | Indonesia | Canada | Belgium | UK | Brazil | Italy | US | Netherlands | Singapore | Japan | Malaysia | China | UAE | India

87% | 90% | 87% | 94% | 90% | 87% | 84% | 91% | 87% | 86% | 84% | 84% | 79% | 90% | 87% | 85% | 83%

28% | 13% | 15% | 25% | 21% | 20% | 18% | 26% | 23% | 23% | 22% | 30% | 27% | 42% | 42% | 49% | 58%
But there is a Shift in Trust-Building From Operational to Societal

16 TRUST BUILDING ATTRIBUTES

<table>
<thead>
<tr>
<th>Societal</th>
<th>Operational</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Listens to customer needs and feedback</td>
<td></td>
</tr>
<tr>
<td>2. High quality products or services</td>
<td></td>
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<tr>
<td>3. Treats employees well</td>
<td></td>
</tr>
<tr>
<td>4. Places customers ahead of profits</td>
<td></td>
</tr>
<tr>
<td>5. Takes actions to address issue or crisis</td>
<td></td>
</tr>
<tr>
<td>6. Has ethical business practices</td>
<td></td>
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<tr>
<td>7. Has transparent and open business</td>
<td></td>
</tr>
<tr>
<td>8. Communicates frequently and honestly</td>
<td></td>
</tr>
<tr>
<td>9. Works to protect/improve environment</td>
<td></td>
</tr>
<tr>
<td>10. Addresses society’s needs</td>
<td></td>
</tr>
<tr>
<td>11. Positively impacts the local community</td>
<td></td>
</tr>
<tr>
<td>12. Innovator of new products</td>
<td></td>
</tr>
<tr>
<td>13. Highly regarded, top leadership</td>
<td></td>
</tr>
<tr>
<td>14. Delivers consistent financial returns</td>
<td></td>
</tr>
<tr>
<td>15. Ranks on a global list</td>
<td></td>
</tr>
<tr>
<td>16. Partners with third parties</td>
<td></td>
</tr>
</tbody>
</table>

Societal attributes more important to building future trust

Current trust driven by operational attributes

Edelman trust barometer
2013 Annual Global Study

ND-GAIN
Post-COVID Global Adaptation Index
### Table 1: Ten Global Risks of Highest Concern in 2014

<table>
<thead>
<tr>
<th>No.</th>
<th>Global Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fiscal crises in key economies</td>
</tr>
<tr>
<td>2</td>
<td>Structurally high unemployment/underemployment</td>
</tr>
<tr>
<td>3</td>
<td>Water crises</td>
</tr>
<tr>
<td>4</td>
<td>Severe income disparity</td>
</tr>
<tr>
<td>5</td>
<td><strong>Failure of climate change mitigation and adaptation</strong></td>
</tr>
<tr>
<td>6</td>
<td>Greater incidence of extreme weather events (e.g. floods, storms, fires)</td>
</tr>
<tr>
<td>7</td>
<td>Global governance failure</td>
</tr>
<tr>
<td>8</td>
<td><strong>Food crises</strong></td>
</tr>
<tr>
<td>9</td>
<td>Failure of a major financial mechanism/institution</td>
</tr>
<tr>
<td>10</td>
<td>Profound political and social instability</td>
</tr>
</tbody>
</table>

Note: From a list of 31 risks, survey respondents were asked to identify the five they are most concerned about.
More than 70% of corporate respondents saw risks to their supply and value chains from climate disruption.

Why must supply chains collaborate to combat climate risk?
CDP Global Supply Chain Report Launch, see how leading companies are catalyzing change.

Cdp.net/supplychain
On average, US firms saw supply chain accounting for 60% of environmental costs.

Food and Beverage Sector: 92% of environmental costs in supply chain.

Source: GreenBiz “State of Green Business Report 2013”
CORPORATE RESPONSIBILITY A BUSINESS STRATEGY

90% companies note that sustainability is a part of business strategy

• 61%: sustainability measures added to company’s profit when on the agenda of top management

Millennials’ Expectations

• **88%** believe the for-profit sector should address social and environmental issues
  
  Source: 8095 survey

• **Almost 90%** would choose an employer with corporate responsibility values that echo their own and 90% would consider leaving if a firm’s corporate responsibility values no longer matched their expectations.

  Source: 2010 Net Impact
Unlocking Global Adaptation Solutions
Country Resiliency Index to Inform Decision-Making
## ND-GAIN Country Rankings 2012

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Trend</th>
<th>Score</th>
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<tbody>
<tr>
<td>119</td>
<td>Swaziland</td>
<td>=</td>
<td>53.5</td>
</tr>
<tr>
<td>120</td>
<td>India</td>
<td>▲</td>
<td>53.4</td>
</tr>
<tr>
<td>121</td>
<td>Tajikistan</td>
<td>=</td>
<td>53.3</td>
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<tr>
<td>122</td>
<td>Syria</td>
<td>▼</td>
<td>52.6</td>
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<tr>
<td>123</td>
<td>Libya</td>
<td>▼</td>
<td>52.1</td>
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<td>124</td>
<td>Micronesia</td>
<td>▼</td>
<td>51.8</td>
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<tr>
<td>125</td>
<td>Cuba</td>
<td>=</td>
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<tr>
<td>126</td>
<td>Senegal</td>
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<tr>
<td>127</td>
<td>Benin</td>
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<td>128</td>
<td>Zambia</td>
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<td>129</td>
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<td>130</td>
<td>Rwanda</td>
<td>▲</td>
<td>49.9</td>
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<td>131</td>
<td>Djibouti</td>
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<td>132</td>
<td>Pakistan</td>
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<td>Cambodia</td>
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<td>Laos</td>
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<td>140</td>
<td>Tanzania</td>
<td>▲</td>
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<td>141</td>
<td>Burkina Faso</td>
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<td>142</td>
<td>Sao Tome &amp; Principe</td>
<td>▲</td>
<td>48.1</td>
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<tr>
<td>143</td>
<td>Cameroon</td>
<td>=</td>
<td>47.9</td>
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<tr>
<td>144</td>
<td>Comoros</td>
<td>▲</td>
<td>47.5</td>
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<tr>
<td>145</td>
<td>Bangladesh</td>
<td>▲</td>
<td>47.3</td>
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<tr>
<td>146</td>
<td>Equatorial Guinea</td>
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<td>47.1</td>
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<tr>
<td>146</td>
<td>Madagascar</td>
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<td>47.1</td>
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<td>Maldives</td>
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<td>Indicator</td>
<td>1995 to 2012</td>
<td>Score</td>
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</tr>
<tr>
<td>Readiness</td>
<td></td>
<td>0.531</td>
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<tr>
<td>Economic</td>
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<td>0.678</td>
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<tr>
<td>Business freedom</td>
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<td>0.531</td>
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<td>Financial freedom</td>
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<td>0.500</td>
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<tr>
<td>Fiscal freedom</td>
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<td>0.793</td>
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<td>Government spending</td>
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<tr>
<td>Investment freedom</td>
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<tr>
<td>Monetary freedom</td>
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<td>0.766</td>
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<tr>
<td>Trade freedom</td>
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<td>0.755</td>
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<td>Governance</td>
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<tr>
<td>Control of corruption</td>
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<td>0.343</td>
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<td>Political stability &amp; non-violence</td>
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<tr>
<td>Voice &amp; accountability</td>
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<td>0.497</td>
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<tr>
<td>Social readiness</td>
<td></td>
<td>0.511</td>
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<tr>
<td>Tertiary education</td>
<td></td>
<td>0.403</td>
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<tr>
<td>Labor freedom</td>
<td></td>
<td>0.510</td>
<td></td>
</tr>
<tr>
<td>Mobile penetration</td>
<td></td>
<td>0.952</td>
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</tr>
<tr>
<td>Rule of law</td>
<td></td>
<td>0.398</td>
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</tr>
</tbody>
</table>
Water
Precipitation change
Freshwater withdrawal
Access to improved water supply
ND-GAIN Vulnerability Sectors and Indicators

Food

Crop yield change
Food import dependency
Agriculture capacity, including irrigation and fertilizer
Health

Climate-change-induced disability adjusted life years
External health resource dependency
Health workers per capita
Ecosystems
Projected biome threat
Dependency on natural capital
Involvement in international environmental conventions
Human Habitat

Urban risks from climate-related natural disasters
Excess urban growth
Quality of trade and transport infrastructure
ND-GAIN Vulnerability Sectors and Indicators

Coastal Infrastructure

Land area less than 10m above sea level
Population living less than 10m above sea level
### Energy Infrastructure

Dependency on hydropower that is sensitive to climatological factors

Population with access to reliable electricity
Transportation Infrastructure

Flood risks
Paved roads
It will take more than 100 years at current rates for lower income countries to reach the current resiliency of OECD countries.

Countries Grouped by Income Level:
- LIC: Low income countries
- Global Avg.
- HIC: High income countries
- BRICS: Emerging national economies: Brazil, Russia, India, China, South Africa

Years to reach current OECD (Organization for Economic & Development Countries) levels of resiliency:
- LIC: 100 years
- Global Avg.: 80 years
- HIC: 60 years
- BRICS: 40 years
ND-GAIN Users

Notre Dame Global Adaptation Index in CRS Countries

Legend:
- Green: Lower Risk
- Yellow: Medium Risk
- Red: Higher Risk

The ND-GAIN score is calculated on a scale from 0 to 100, with 0 indicating a country is less vulnerable and more ready and 100 indicating it is more vulnerable and less ready.
The ND-GAIN Matrix

<table>
<thead>
<tr>
<th>Vulnerability</th>
<th>Readiness</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOW</td>
<td>LOW</td>
</tr>
<tr>
<td>HIGH</td>
<td>HIGH</td>
</tr>
</tbody>
</table>

- **Greatest Challenges and Urgency to Act**
- **Great Challenges, but Adopting Solutions**
- **Few Present Challenges, Time to Get Ready**
- **Well-Positioned with Few Challenges**

Vulnerability and Readiness scores for Myanmar, Laos, Cambodia, Vietnam, Philippines, Indonesia, Thailand, Malaysia, and Singapore.
• Multinational or local corporation
• Local partner
• ND-GAIN Country rank below 60
• Measureable resiliency
• http://gain.org/nd-gain-prize
Collaborate with Us: ND-GAIN Future Plans

Regional Assessments

Sector Assessments

Urban Assessments

Readiness * Vulnerability * Corporate Stakeholders

- Joyce Coffee
- Managing Director
- Notre Dame Global Adaptation Index
- www.nd-gain.org
- jcoffee@nd.edu
- 1 (574) 807-9322
Thank You

PARKING LOT

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ND-Global Adaptation Index

- Flagship global index pairing vulnerability with readiness and aimed at private sector
- Free, open source, university led
- Unlock adaptation solutions in the corporate and development sectors that improve livelihoods and strengthen market positions
Global Forces Driving Adaptation

- Globalization
- Urbanization
- Population growth
- Civil strife
- Water and food scarcity
- Extreme weather
- Rise of the millennial generation
- Higher consumer expectations
The Adaptation Market

- Green Climate Fund targeting annual disbursements to emerging economies of up to $100B by 2020
- Global infrastructure industry projected to grow to $3.3B in next 4 years.
- 2011 global losses from natural disasters $380B
- 73% of executives see physical risks from climate change in their supply chain
ND-GAIN Utility

- Raise awareness of value chain risk and opportunity
- Help corporations, governments, and charitable organizations prioritize investments
  - New Markets, Products & Services
  - Risk Mitigation
  - Corporate Social Responsibility
ND-GAIN Indicator Selection

- Global coverage
- Transparent and open
- Time-series
- Freely accessible
- Quality checked
- Nationally comprehensive
- Actionable
Adaptation Quantification

Potential measures

• Climate change measures

• Climate readiness measures
  • Stormwater catch-basin restrictors in place (built environment)
  • Permeable pavement built (built environment)
  • Water control structures sized for extreme precipitation (natural environment)
  • Urban Heat Island area planted with climate ready trees (natural environment)

• Surveillance measures
  • Heat-related fatalities per year (people)
  • Street closure hours per year due to flooding (people, built environment)
  • Power shut down hours per year (people, built environment)
  • Heat-related school and labor absences per year, (people)
  • Beach closure days per year, (natural environment)