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Behind the Headlines for Climate Risk: One Size Does Not Fit All The Nation's Three Largest Cities Demonstrate Climate Leadership

The impacts of climate change are upon us and scientists report that we can expect continued change and more frequent extreme weather. Such change can exacerbate the challenges of aging infrastructure, impact municipal revenues, disrupt economies, impact public health and displace populations. The Fourth National Climate Assessment Report outlines the varying regional impacts in the United States.¹ One thing is clear: climate risk is not one size fits all.

China ranks first and the U.S. ranks second in the world for annual CO₂ emissions, the leading greenhouse gas (GHG).² Globally, cities play an important role in tackling climate change, as these urban centers account for more than 70% of GHG emissions.³ What are our nation's cities doing to address climate change?

Figure 1: The Nation's Three Largest Cities

City	KBRA GO Bond Rating	2017 Population (millions)*	Climate Indicators**
New York	not rated	8.6	Temperature rise, Severe storms, Sea level rise, Coastal flooding
Los Angeles	AA	4.0	Temperature rise, Wildfires, Drought
Chicago	A	2.7	Temperature rise

*U.S. Census

**Source: Climate Central; CMIP-5, coupled Model Intercomparison Project, World Climate Research Programme

¹ USGCRP, 2018: Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II: Report-in-Brief [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, 186 pp.

² <https://cdiac.ess-dive.lbl.gov/trends/emis/top2014.tot>

³ <https://www.worldbank.org/en/topic/urbandevelopment/overview>



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Aside from extreme events, climate change evolves slowly but has been accelerating. In many areas of the nation, the impacts of climate change pose longer-term risks. As climate change continues, the ability to respond will vary among state and local bond issuers. A focus on planning and adaptation needs to start well in advance, and those cities that actively prepare can better mitigate the potential economic and human impacts of climate change. Our nation's three largest cities provide an interesting illustration of a concerted response to climate challenge.

In this comment KBRA endeavors to bridge the scientific concepts of climate change and the resulting impact on municipal credits. To that end, we are working with Climate Central, a leading climate research organization, to examine the climate risks facing the nation's largest cities.

Why Are There Different Climate Projections?

In making decisions about adaptation projects, governments rely on scenarios to identify risks from, and to develop responses to, climate change. The G20's Task Force on Climate-related Financial Disclosure recommends the use of scenario analysis to help organizations assess the impact of climate change on their activities.⁴

Scientific climate scenarios simulate future climate outcomes in response to future atmospheric GHGs. Future emission levels result from assumptions regarding economic, policy, technology, land use and demographic futures. The scenarios do not model sudden shocks, such as an extreme weather event, with simultaneous events.

The scenarios are called representative concentration pathways (RCPs),⁵ and are used for analyzing potential climate change. The Intergovernmental Panel on Climate Change has released four RCPs (RCP2.6, RCP4.5, RCP6.0, and RCP8.5) so that climate research teams globally can work from a consistent set of assumptions and scenarios.

The best-case scenarios, RCP2.6 and RCP4.5, assume a level of global cooperation and technological innovation in CO₂ removal from the atmosphere that are not yet demonstrated. For example, RCP4.5 is predicated on all nations sharing a common global emissions price, emergence of large-scale CO₂ capture and storage, and global population peaking in 2065. In addition, global land use is altered with a reforestation program, and a decrease in cropland enabled by considerable yield increases and dietary changes. RCP6.0 reflects progress made in international cooperation toward emissions reduction.

RCP8.5, sometimes referred to as "business as usual," reflects continued population growth, continued dependence on fossil fuels, and lower technology development. RCP8.5 assumes energy consumption continues to grow for several decades. RCP8.5 is the worst case of all four scenarios and the one which currently tracks closest to actual global emissions.

Long-Term Risks Require Planning and Resources

All else equal, communities with vibrant economies will be better positioned to respond to climate change. These communities will likely have both better market access for capital and greater resources to fund needed planning and adaptation projects for their respective climate risks.

⁴ <https://www.fsb-tcfd.org/wp-content/uploads/2017/06/FINAL-2017-TCFD-Report-11052018.pdf>

⁵ The fifth Assessment Report adopted by the Intergovernmental Panel on Climate Change in 2014.

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Temperature Rise

While climate risks vary among the nation's largest cities, temperature rise is a commonality. The past five years—2014 to 2018—are the warmest on record since 1880, when the National Oceanic and Atmospheric Administration (NOAA) first started tracking global heat;⁶ and temperatures are expected to continue this rising trend. Some citizens, such as the elderly, are more vulnerable to extreme heat. According to the National Weather Service, heat is the number one weather-related killer.

Figure 2: Number of Heat Danger Days ¹		
	2000	2050
New York City	5	28
City of Los Angeles	16	29
City of Chicago	4	32
Phoenix	22	167

¹Temperature and humidity combine to feel above 105°F.

Source: Climate Central; CMIP-5, Coupled Model Intercomparison Project, World Climate Research Programme.

To put the expected temperature change for New York City, Los Angeles and Chicago in perspective, these cities are expected to have high heat days beyond what is currently experienced in Phoenix by 2050. All three cities are taking proactive steps against becoming heat islands. For example, Los Angeles is using cool roofs, cool pavement and planting trees.⁷ Air conditioning use will increase, and Chicago's large-scale smart meter program is expected to help manage energy demand. Aside from temperature rise, Chicago is not experiencing changes to climate indicators (drought, flood, precipitation) to the same extent as many other U.S. cities.

Drought

The Southwest is the hottest and driest region in the U.S. This already parched region is expected to get hotter and, in its southern half, significantly drier. According to NASA, droughts and heatwaves in the Southwest are projected to become more intense over the coming decades. Consecutive weeks of severe drought in the County of Los Angeles are trending up (see Figure 3).

The majority of the Los Angeles water supply (approximately 85%) originates from snowmelt.⁸ In response to record drought:

- Mayor Eric Garcetti issued a directive for an increase in water security and a reduction in water use
- The city's water board increased enforcement authority and penalties to improve drought response

⁶ <https://www.ncei.noaa.gov/news/global-climate-201812>

⁷ <https://www.lamayor.org/sites/g/files/wph446/f/page/file/Resilient%20Los%20Angeles.pdf>

^{8,10} Department of Water and Power City of Los Angeles Water Revenue Bond Official Statement, November 2018.

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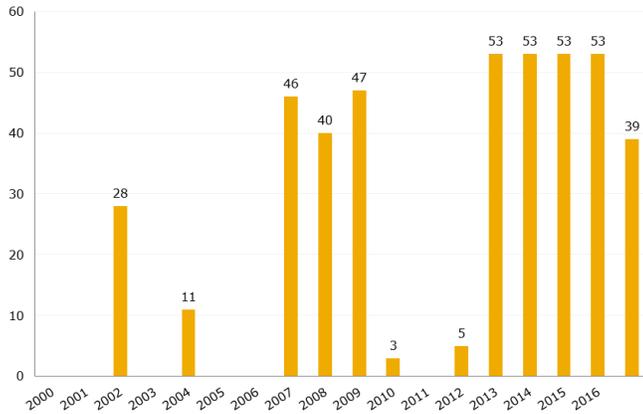


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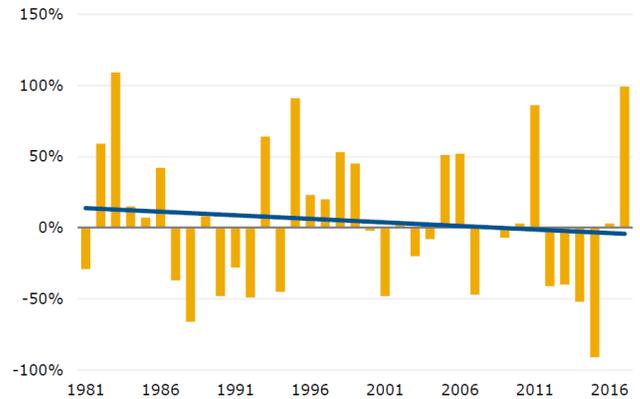
The City’s goal is to recycle 100% of wastewater by 2035. The state requires water management plan updates every five years, and the City of Los Angeles’s 20-year Sustainable City pLAn addresses water supply.⁹ The city believes that through management, expanded recycling conservation programs, and development of other local resources, it will have adequate water supplies for the foreseeable future.¹⁰

**Figure 3: Consecutive Weeks of Severe Drought
Los Angeles County**



Mitigation Center, University of Nebraska
Supported by USDA, NOAA, National Drought
Source: Climate Central; U.S. Drought Monitor
Network.

**Figure 4: California Snowpack
April 1 Snow Water Equivalent**



Median normal based on the period from 1981 – 2016.
Data through 3/27/2018.
Source: Climate Central; USDA/NRCS SNOTEL

⁹ <http://plan.lamayor.org/>

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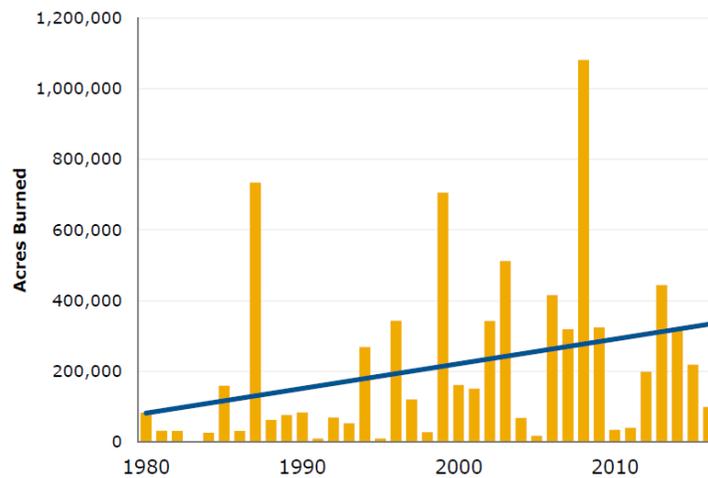
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Wildfires

High temperatures and drought set up conditions conducive to wildfires. In addition to public safety hazards, wildfires threaten the tax base when property is damaged or destroyed. Firefighting budgets are more likely to have unbudgeted spending needs for extreme events. Figure 5 shows the growing trend of wildfires in California.

Figure 5: Number of Acres Burned California



Source: Climate Central; United State Geological Survey

Flooding and Sea Level Rise

NYC’s strategic plan identifies coastal flood risk and extreme heat as significant threats.¹¹ As sea levels rise, the amount of property and infrastructure in New York City that is susceptible to coastal flooding events increases.

According to one of the most recent sea level rise scenarios provided by NOAA,¹² a mild flood of 3.5 feet above the average high tide may be expected to happen about once a year in NYC by 2020. Figure 6 displays the miles of roads in NYC exposed to flooding at a flood depth of 3 feet. KBRA also understands that under the same NOAA scenario a mild flood depth may reach 6 feet above the current average high tide by 2050. A major flood, one with about a 1% chance of happening each year, could swell from 7.2 feet in 2020 to 9.7 feet above the current average high tide by 2050.

Figure 6: New York City Flood Risk Highlights

Flood depth in feet relative to high tide ^a	3	6	7	10
Roads exposed (miles) ^b	49 (0.7%)	352 (5.2%)	514 (7.6%)	940 (14.0%)

^aRelative to average high tide, MHHW at NOAA tide station

^bU.S. Census, 2010.

¹¹ One New York: The Plan for a Strong and Just City, Executive Summary, <https://onenyc.cityofnewyork.us/executive-summary/>
^{12,13} Sweet, W.; Kopp, R.; Weaver, C.; Obeysekera, J.; Horton, R.; Thieler, E.; Zervas, C.: Global and Regional Sea Level Rise Scenarios for the United States, NOAA Technical Report NOS CO-OPS 083 (2017) used for the 2018 U.S. National Climate Assessment.

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Source: *Climate Central Risk Finder. Reflects NOAA's highest and most recent sea level rise scenario.*¹³

NYC's strategic plan includes numerous coastal defense measures, including:

- Coastal protection and flooding projects such as green infrastructure, wastewater system upgrades, and construction of overflow retention tanks
- Effort with the Federal Emergency Management Agency to reassess New York City's flood maps, which will illustrate how floodplains will migrate inland and to higher land elevations with projected sea level rise
- An update to the city's Flood Resilience Zoning rules to provide forward-looking rules for floodplain development. Nearly half a million New Yorkers live in the city's floodplain
- A long-term study of climate risks to the Manhattan tip in the 2100s has been initiated

Cities Lead in Mitigation

All three cities are leaders in reducing emissions and promoting sustainability. They partner with national and global organizations and are committed to policies consistent with the 2015 Paris Agreement. Some brief examples of their efforts and links to their resiliency plans are shown below:

New York City

- Reduce GHG emissions 80% by 2050 relative to 2005 levels
- Programs to promote building energy efficiency (80% of NYC GHGs)
- Energy rating system for buildings greater than 25,000 SF, publicly displayed, begins in 2020
- Effort to reduce waste disposal by 90% by 2030 relative to 2005 levels

City of Los Angeles

- Reduce GHG emissions 45% below 1990 levels by 2025 and 80% by 2050
- Resilience projects and initiatives at LAX airport and the Port of Los Angeles
- Commitment to purchase only zero-emissions buses by 2030
- Effort to build the largest municipal electric fleet in America

City of Chicago

- Reduce GHGs by 25% below 1990 levels by 2020 and 80% below 1990 levels by 2050¹⁴
- Energy rating system for most buildings greater than 50,000 SF, publicly displayed, begins in 2019
- Smart meters in homes and businesses

Long-Term Outcomes Depend on Intervention

Long-term future outcomes are extremely difficult to assess with certainty because consistent human response and intervention is difficult to predict. Among the factors driving these outcomes:

- The arc of global emission trends
- Public policy and individual responses concerning adaptation
- Potential changes in federal disaster response funding or the national flood insurance program

¹⁴ 70% of GHGs in Chicago are from energy use by buildings per http://www.chicagoclimateaction.org/pages/climate_change_101/25.php

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Local governments are the first line of defense in protecting their communities against climate events. Our research suggests that our nation's three largest cities have embarked upon broad efforts to combat and manage the challenges of climate change.

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