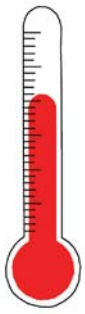


10. Extreme Temperatures

A. Hazard Profile

i. Hazard Description

Extreme temperatures, both hot and cold, have a significant effect on human health and infrastructure in New York City.

Extreme Heat

Extreme heat is one of the leading weather-related killers in the United States. Extreme heat events are most common between June and August when temperatures that are significantly above average are sustained for a prolonged period; these events may also occur in May or September, although this is rare. A heat wave is defined as three or more consecutive days when daily high temperatures reach 90°F or higher.

The effects of extreme heat are exacerbated by high levels of humidity (the amount of moisture in the air). The higher the temperature, the more moisture the air can hold. High humidity lowers the body's ability to cool itself, and can make the temperature feel hotter than it actually is. The combined effect of the temperature and humidity is known as the heat index, or the apparent "feels like" temperature.

The built environment of New York City greatly contributes to the phenomenon known as the "urban heat-island effect." Heat islands develop in areas with extensive built surfaces (concrete, asphalt, and metal). Incoming solar radiation is trapped during the day and is then re-radiated at night. This slows the cooling process, keeping nighttime air temperatures higher than in more rural surrounding areas. Other by-products of the city's activities—such as exhaust fumes, burning furnaces, heating units, smokestacks, and even New York City's dense population—contribute to the phenomenon. In addition, the city's numerous tall buildings often block the cooling winds from the Atlantic Ocean. In infrared satellite photographs of New York City, particularly at night, the city appears as a distinct heat island, as much as 20°F warmer than the surrounding suburbs.

In many cases, extreme heat events are also associated with poor air quality. High humidity and poor air quality are common in New York City during the summer months, when high atmospheric pressure traps hazy and humid air and pollutants near the ground.

Extreme Cold

An extreme cold event typically involves an extended period with temperatures at or below 32°F. In New York City, extended periods of sub-freezing temperatures are most common between December and March. As the temperature drops and wind speed increases, heat can leave the body more rapidly. This phenomenon, known as the wind-chill effect, can exacerbate the impact of an extreme cold event.

ii. Severity

Extreme heat

The National Weather Service (NWS) uses a heat index chart (see Table 3.10.42) to determine what effects the temperature and humidity will have on the population (see Table 3.10.43). The heat index values, however, are calculated in the shade and are not adjusted for different levels of sun exposure. Thus, exposure to full sunshine can make it feel even hotter than the heat index reading. During hot weather the actual heat stress experienced by any individual would depend on the temperature in their location, exposure to sunlight and radiant heat from nearby surfaces, air movement, and their level of physical activity.

Table 3.10.42: NWS Heat Index (Source: NWS, 2013)

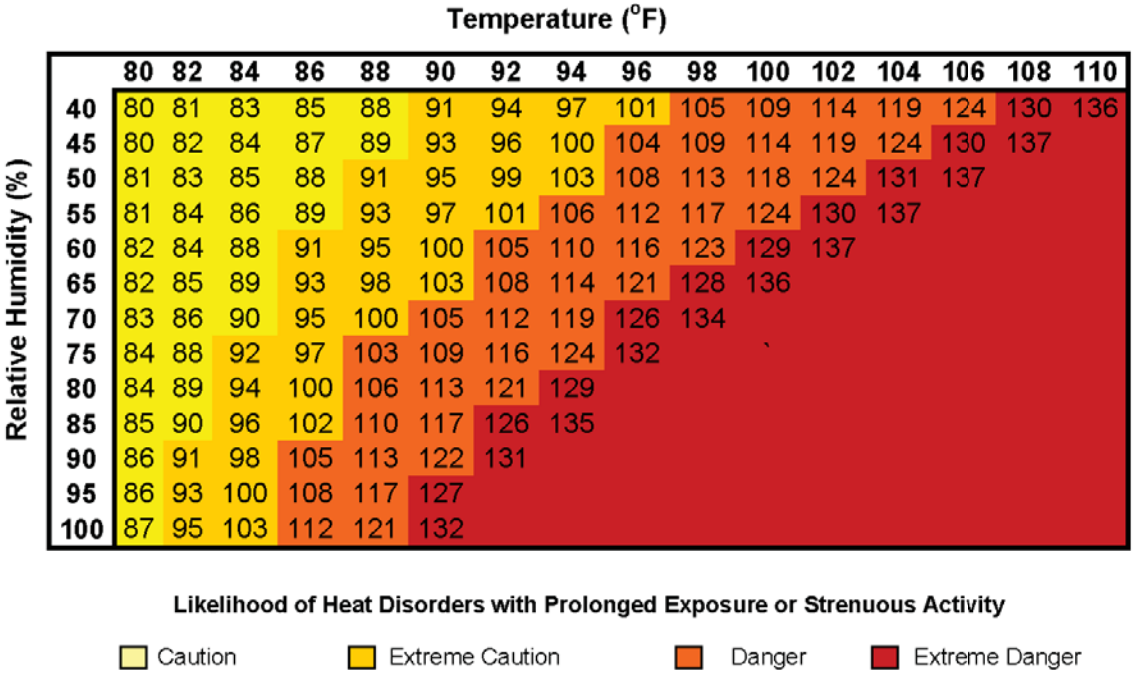


Table 3.10.43: Health Hazards Associated with Heat Index Values (Source: NWS, 2013)

Category	Heat Index	Health Hazards
Extreme Danger	130°F-Higher	Heat stroke/sunstroke is likely with continued exposure
Danger	105°F-129°F	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity
Extreme Caution	90°F-105°F	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity
Caution	80°F-90°F	Fatigue possible with prolonged exposure and/or physical activity

Table 3.10.44: NWS Extreme Heat Products for the New York City Region (Source: NWS, 2013)

Product	Criteria
Heat Advisory	Issued within 24 hours prior to onset of any of the following conditions: · Heat index of 100°F-104°F for any period · Heat index of 95°F-99°F or greater for two consecutive days
Excessive Heat Watch	Issued 24-48 hours prior to onset of the following condition: · Heat index of at least 105°F for at least two consecutive hours
Excessive Heat Warning	Issued within 24 hours of onset of the following condition: · Heat index of at least 105°F for at least two consecutive hours

New York City receives advisories from the NWS when the predicted heat index is 100°F or greater for one or more days, or the predicted heat index is 95°F or greater for two or more days (see Table 3.10.44). These advisories are based on historical weather analysis and mortality data analysis conducted by the New York City Department of Health and Mental Hygiene (DOHMH). To aid in the prediction of and response to extreme heat events, the NWS has worked with DOHMH and the New York City Office of Emergency Management (OEM) to craft standards for products used in New York City's Heat Emergency Plan (see Social Environment, below). Upon issuing an extreme heat advisory, the NWS does the following:

- Includes heat index values and city forecasts
- Issues special weather statements including who is most at risk, safety rules for reducing risk, and the extent of the hazard and heat index values
- Assists state/local health officials in preparing for civil emergency messages

Extreme Cold

The NWS created a wind-chill chart (see Table 3.10.45) that measures the apparent temperature felt on exposed skin due to the combination of air temperature and wind speed. When conditions warrant, the NWS issues wind-chill products for the New York City region (see Table 3.10.46). Although rare, these conditions have occurred throughout New York City's history (see Table 3.10.47).

Table 3.10.45: NWS Wind-Chill Chart (Source: NWS, 2013)

	Temperature (°F)																		
Wind (mph)	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
	5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
	10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
	15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
	20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
	25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
	30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
	35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
	40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
	45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
	50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
	55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
	60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Table 3.10.46: NWS Wind-Chill Products for the New York City Region (Source: NWS, 2013)

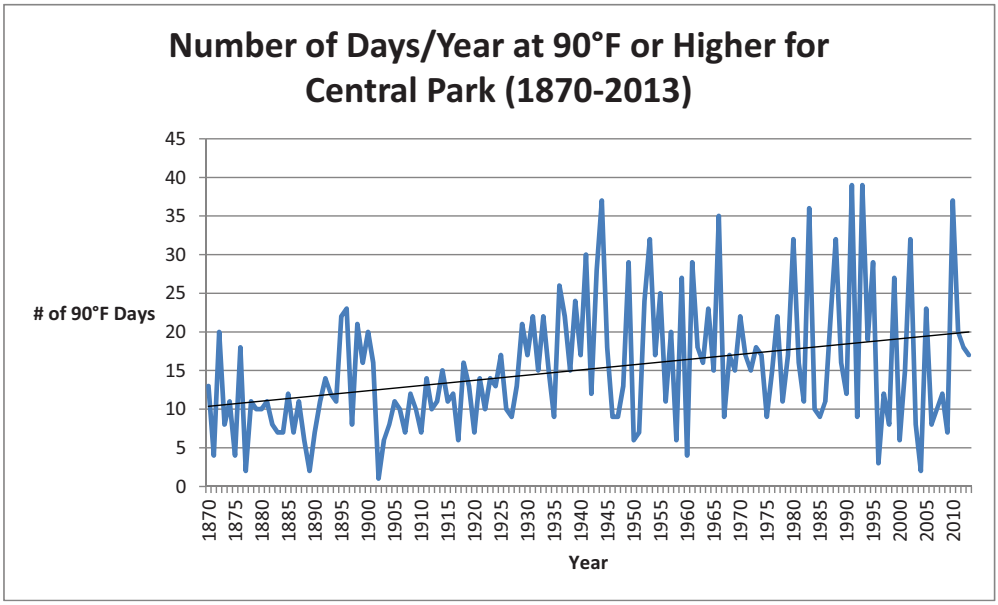
Product	Description
Wind Chill Advisory	Issued when wind-chill values are expected to fall to between -15°F and -24°F
Wind Chill Warning	Issued when wind-chill values are expected to fall to -25°F or colder

iii. Probability

Extreme Heat

Official temperature readings for New York City are taken at Belvedere Castle in Central Park, although temperatures vary throughout the city. Current averages are calculated for the baseline period of 1971 to 2000. Based on data from the New York City Panel on Climate Change (NPCC), New York City currently averages 18 days per year with temperatures at or above 90°F. The city can also expect an average of two heat waves per year with an average duration of four days. Based on historical data from NWS, the annual number of days with high temperatures of 90°F or higher

Figure 3.10.66: Number of Days with Temperatures of 90°F or Higher at Central Park, 1870 to 2013 (Source: NWS, 2013)



at Central Park has been increasing since the late 19th century (see Figure 3.10.66). The number, duration, and intensity of heat waves and days at or above 90°F are expected to continue to increase in the future as a result of climate change (see Future Environment, below).

Extreme Cold

According to the NPCC, using the baseline period of 1971 to 2000, the city currently experiences an average of 72 days per year with minimum temperatures at or below 32°F. This number is expected to decrease in the future as a result of climate change (see Future Environment, below).

iv. Location

Extreme Heat

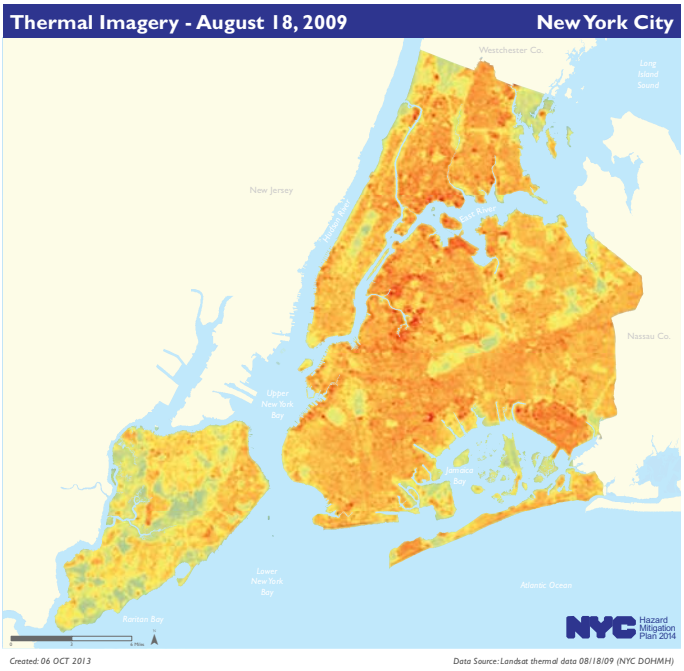
Extreme heat affects all of New York City, although some locations are more at risk than others. For example, sea breezes keep areas near the ocean shoreline cooler during the summer months. Thus, places like John F. Kennedy International Airport (JFK) and the Rockaway Peninsula experience fewer days at or above 90°F annually than locations farther from the ocean, such as Central Park and LaGuardia Airport (LGA).

In addition to keeping all of New York City warmer than surrounding areas, the urban heat island effect also makes some city neighborhoods warmer than others. Not surprisingly, the warmest neighborhoods typically have the densest development (highest concentrations of heat-trapping built structures) and the least vegetation. Figure 3.10.67 is a thermal image of New York City, taken on August 18, 2009, one of the hotter days of that year, and Figure 3.10.68 displays the city's vegetative cover. Comparing the two images reveals that hotspots are generally areas that lack vegetation. These areas are at greatest risk from extreme heat events.

Extreme Cold

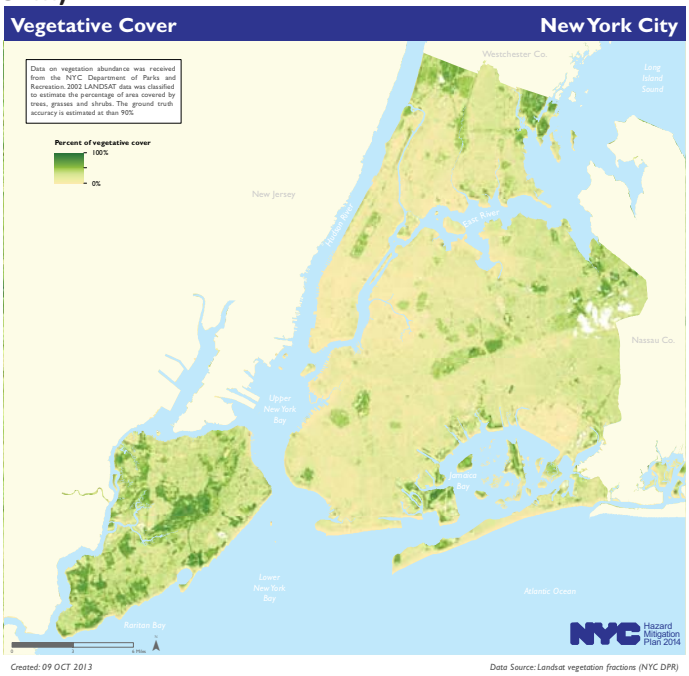
There is generally less variation across the city with extreme cold events than there is with extreme heat events. In general, all of New York City experiences a moderation of cold temperatures due to the combination of the urban heat island effect and proximity to the ocean. Areas along the immediate ocean shoreline are often slightly warmer than areas several miles inland during the colder months of the year. However,

Figure 3.10.67: New York City Thermal Imagery Taken August 18, 2009 (Source: DOHMH)



Notes: *Warmer locations are orange and red, while cooler areas are green and yellow.

Figure 3.10.68: New York City Vegetative Cover (Source: OEM)



wind-chill temperatures along the immediate coast may be lower than those of areas several miles inland due to higher winds near the water, even if the actual air temperature is higher. Lower-density neighborhoods of the city with greater natural cover and less asphalt may also be a few degrees colder, although this effect is less pronounced during the colder months.

iv. Historic Occurrences

Table 3.10.47 describes instances of extreme temperatures in New York City since 1995. Note that thresholds for the activation of the City's Heat Emergency Plan (see Social Environment, below) were adopted in 2007 and require the issuance of at least a heat advisory from NWS. For extreme heat events in 2007 or later, Table 3.10.47 only includes those for which these criteria were met.

Table 3.10.47: Extreme Temperatures in New York City 1995 to 2013

Start	Event	Location	Description
July 13, 1995	Extreme heat	Citywide	• Temperatures rise to a record high of 102°F in Central Park • 7 people die, and hundreds more are treated for heat-related illness
July 4, 1999	Extreme heat	Citywide	• 3 consecutive days of hot, humid weather • On July 4, temperatures reach the mid to upper 90s with heat indices from 100 to 105°F • 31 deaths reported
January 17, 2000	Extreme cold	Citywide	• Temperatures drop to 3°F in Central Park and do not rise above 20°F for 2 days • Strong, gusty northwest winds combine with well-below-normal temperatures to produce wind-chill values of -15°F to -30°F • 3 deaths reported
January 27, 2000	Extreme cold	Citywide	• Strong winds combine with temperatures in the teens and single digits to produce wind-chill values of -30°F at JFK and -28°F at LGA • No deaths reported
August 5, 2001	Extreme heat	Citywide	• 6 consecutive days of temperatures at or above 90° F in Central Park • High temperatures in Central Park reach 103°F on August 9, with heat indices between 105 and 110° F • OEM opens cooling centers throughout the city • 4 deaths reported
July 2, 2002	Extreme heat	Citywide	• Temperatures rise into the mid and upper 90s across the region • Overnight low temperatures remain in the lower 80s • On July 4, the temperature reaches 98°F at LGA, setting a new record • Heat indices of 100 to 105°F • OEM opens cooling centers throughout the city • No deaths reported
July 29, 2004	Extreme heat	Citywide	• 8 consecutive days of temperatures at or above 90°F in Central Park • High temperatures in the mid to upper 90s with heat indices as high as 100 to 105°F on July 29 • No deaths reported
July 31, 2006	Extreme heat	Citywide	• 4 consecutive days with temperatures at or above 90°F in Central Park • Temperatures of 95°F to 100°F with heat indices of 105 to 115°F • OEM opens 383 cooling centers throughout the city • 40 heat stroke deaths and roughly 100 excess natural-cause deaths reported • Scattered power outages reported
February 4, 2007	Extreme cold	Citywide	• Subfreezing temperatures for 5 consecutive days • Temperature drops into the single digits with a wind chill of -5°F to -10°F on February 5 • 11 deaths reported during and following this period
March 6, 2007	Extreme cold	Citywide	• Daily temperatures below freezing for 2 consecutive days, averaging 19 degrees below normal for 4 consecutive days • Temperature drops to 11°F with a wind chill of -6°F in Central Park on March 6 • 1 death reported
June 7, 2008	Extreme heat	Citywide	• 4 consecutive days with temperatures at or above 90°F in Central Park • Temperatures in the mid-90s with heat indices around 100°F • OEM activates Heat Emergency Plan and opens cooling centers throughout the city • 10 heat-stroke deaths reported in summer 2008

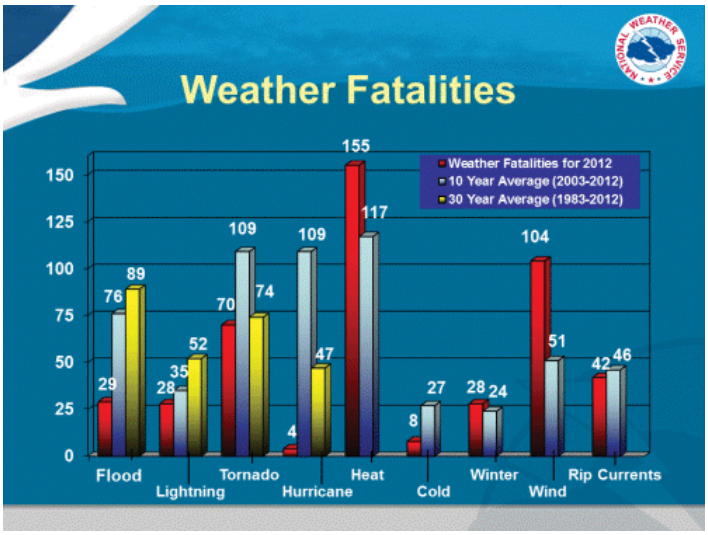
Start	Event	Location	Description
August 16, 2009	Extreme heat	Citywide	• 4 consecutive days with temperatures at or above 90°F in Central Park • Heat indices reach the mid-90s • OEM activates Heat Emergency Plan and opens cooling centers throughout the city
June 27, 2010	Extreme heat	Citywide	• 3 consecutive days with temperatures at or above 90°F in Central Park • Heat indices reach the upper 90s • OEM activates Heat Emergency Plan and opens 488 cooling centers throughout the city
July 4, 2010	Extreme heat	Citywide	• 4 consecutive days with temperatures at or above 90°F, with a maximum of 103°F and heat index values between 105°F and 110°F in Central Park on July 6 • OEM activates Heat Emergency Plan and opens 480 cooling centers throughout the city • 10 heat-stroke deaths reported
July 16, 2010	Extreme heat	Citywide	• 4 consecutive days with temperatures at or above 90°F • Heat indices 100°F to 105°F on July 16 • OEM activates Heat Emergency Plan and opens 453 cooling centers throughout the city
August 4, 2010	Extreme heat	Citywide	• 3 consecutive days with temperatures at or above 90°F in Central Park • Heat indices reach the upper 90s • OEM activates Heat Emergency Plan and opens 436 cooling centers throughout the city
July 21, 2011	Extreme heat	Citywide	• 4 consecutive days with temperatures at or above 90°F, • Maximum temperature of 104°F with heat index of 115°F on July 2 in Central Park • OEM activates Heat Emergency Plan and opens 504 cooling centers throughout the city • 30 heat-stroke deaths reported
June 20, 2012	Extreme heat	Citywide	• 3 consecutive days with temperatures at or above 90°F • Temperatures in the mid-90s with heat indices in the upper 90s in Central Park • OEM activates Heat Emergency Plan and opens more than 400 cooling centers throughout the city
June 29, 2012	Extreme heat	Citywide	• 3 consecutive days with temperatures at or above 90°F and heat indices as high as 100°F in Central Park • OEM activates Heat Emergency Plan and opens cooling centers throughout the city
July 4, 2012	Extreme heat	Citywide	• 4 consecutive days with temperatures at or above 90°F in Central Park • Temperatures in the mid-to-upper 90s with heat indices in the upper 90s in Central Park • OEM activates Heat Emergency Plan and opens cooling centers throughout the city
July 16, 2012	Extreme heat	Citywide	• 3 consecutive days with temperatures at or above 90°F at Central Park • Temperature reaches 100°F in Central Park and 101°F at LaGuardia Airport on July 18, with heat index reaching or exceeding 105°F at both locations
July 4, 2013	Extreme heat	Citywide	• 3 consecutive days with temperatures at or above 90°F and heat indices above 95°F in Central Park
July 14, 2013	Extreme Heat	Citywide	• 7 consecutive days with temperatures at or above 90°F in Central Park • Maximum of 98°F in Central Park on July 18, with heat indices 100°F to 105°F • July 17 through July 20 set daily records for highest minimum temperature, not dropping below 80°F at night • OEM activates Heat Emergency Plan and opens cooling centers throughout the city

B. Vulnerability Assessment

i. Social Environment

Extreme temperatures cause more fatalities in the United States than other natural hazards, with an average of 144 combined heat and cold-related deaths per year between 2003 and 2012 (see Figure 3.10.69). However, nationally, average annual mortality from extreme heat (117 deaths per year) was significantly higher than from extreme cold (27 deaths per year).

Figure 3.10.69: Annual Weather Fatalities in the United States (Source: NOAA, 2013)



Extreme Heat

Prolonged exposure to extreme heat may lead to serious health problems, including dehydration, heat exhaustion, and, in severe cases, heat stroke. Symptoms of heat exhaustion include confusion, dizziness, fatigue, nausea, headaches, and muscle cramps. If proper action is not taken, heat exhaustion may turn into heat stroke.

Heat stroke occurs when the body is no longer able to regulate its internal temperature, resulting in a body temperature of greater than 105°F. Common symptoms include seizures, disorientation, loss of consciousness, and complications involving the central nervous system. Heat stroke can cause permanent damage to the brain and other vital organs and in many cases may result in death.

Heat exposure can aggravate underlying chronic health conditions such as asthma or cardiovascular disease, especially when it is associated with poor air quality. Thus, during heat waves, overall mortality rates often rise above what would be expected on normal summer days due to these secondary health impacts. For example, in 2006 there were approximately 100 excess natural-cause deaths attributed to a severe heat wave that also caused 40 heat-stroke deaths. The lack of air conditioning in particular greatly increases heat stress and the risk of heat related illness and death for vulnerable individuals. According to the Centers for Disease Control and Prevention (CDC), approximately 80% of heat-related deaths among New York City residents are those exposed in their homes.

New York City's urban environment exacerbates hazardous conditions resulting from extreme heat. For example, stagnant atmospheric conditions during the summer can contribute to poor air quality and increase the rate of heat-related illness and death. Consequently, people living in New York City are at greater risk from the effects of a heat wave than those living in less urbanized areas.

Each year, on average, there are 450 emergency department (ED) visits and 150 hospital admissions for heat-related illness, and 13 heat stroke deaths among New York City residents (see Table 3.10.48). Between 1997 and 2010, 152 heat-stroke deaths were reported by the New York City Office of the Chief Medical Examiner (OCME) and Bureau of Vital Statistics. These values do not include excess natural cause mortality due to secondary impacts of heat, which are generally more numerous than direct heat stroke deaths. DOHMH estimates that heat-related mortality due to secondary impacts increased by an average of 6.5% during 12 prolonged heat waves which occurred throughout this period, accounting for approximately 1,090 additional deaths.

Table 3.10.48: Hospital Admissions and ED Visits for Heat Illness and Heat Stroke Deaths, 2001-2011 (Source: DOHMH)

Year	Hospital Admissions	Treated & Released from ED*	Heat Stroke Deaths
2001	203	–	13
2002	216	–	16
2003	152	–	6
2004	53	–	1
2005	170	512	7
2006	322	598	50
2007	90	382	1
2008	150	462	10
2009	54	228	2
2010	247	669	11
2011	237	–	34
Total	**1894**	**2851**	**151**

Notes

1. Hospital admissions calculated as NYC residents admitted to a NYC hospital and ED visits calculated as NYC residents treated and released from an NYC emergency department during the months of May-Sept.

2. *ED data available from 2005 onwards. 2011 data not yet available.

Based on consultation with the NWS, the City activates its Heat Emergency Plan, which outlines the coordinated response to mitigate the effects of heat and humidity on critical infrastructure, at-risk populations, and New York City operations. When the heat index is predicted to be dangerously high, the City also opens cooling centers in air-conditioned public community centers, senior centers, and public libraries to offer heat relief.

Extreme Cold

Extreme cold can be dangerous and result in serious health issues. When exposed to cold temperatures for an extended period, the body loses heat faster than it can generate it. This causes the body's internal temperature to drop, resulting in hypothermia. Early symptoms of hypothermia include shivering, fatigue, loss of coordination, and disorientation. If continued untreated, this condition becomes more serious, with recognizable symptoms including blue skin, dilated pupils, slow pulse and breathing, or loss of consciousness. Hypothermia can have serious impacts on the brain and often affects the victim's ability to move or think clearly. According to DOHMH, there were nearly 200 hypothermia-related hospital admissions and ED visits on average each year from 2005 to 2010.

Another serious condition brought on by extreme cold is frostbite, a freezing of the body's outer tissue. This most commonly occurs in the outer extremities like the nose, ears, cheeks, chin, fingers, and toes. Some symptoms of frostbite include numbness, tingling or stinging, aching, and discoloration of the skin. Frostbite can cause permanent damage to the body tissue and in severe cases may result in the need for amputation.

Cold exposure can also exacerbate underlying chronic illnesses, such as asthma and other respiratory diseases. Any utility disruption or building systems failure that leads to a lack of heat can greatly increase the risk of hypothermia and exacerbation of chronic heart and lung conditions among vulnerable residents. The use of gas stoves or other unvented fuel burning supplemental heat sources can cause dangerous exposures to carbon monoxide. During power outages, people living in healthcare facilities such as senior living centers and adult care facilities without backup power are also at increased risk. Icy conditions resulting from the cold may also contribute to falls and other injuries for those who venture outside.

DOHMH issues a Cold Weather Alert for the city when temperatures fall below 32°F between the hours of 4 PM and 8 AM. During extreme cold events, the City will also open warming centers and increase outreach to the homeless population. The New York City Police Department (NYPD) monitors the city for individuals in need of shelter and transports them to the nearest Department of Homeless Services shelter or 911 receiving hospital.

Vulnerable Populations

Although the health impacts of extreme temperatures can affect anyone who experiences prolonged exposure, certain populations are particularly at risk. Below are some groups that are especially vulnerable to the impacts of both extreme heat and extreme cold (for more information on vulnerable populations, see section 3.4: New York City's Hazard Environment).

- Individuals age 65 and older
- Infants and children under age five
- People with pre-existing medical conditions (including heart disease, diabetes, or respiratory problems such as chronic asthma)
- People who are obese (for extreme heat) or underweight (for extreme cold)
- People living in poverty (for poverty thresholds refer to the U.S. Census Bureau (website link provided at the end of section 10) and section 3.4: New York City's Hazard Environment)
- People without air conditioning (for heat) or those with inadequate heat (for cold)
- People who speak little or no English
- Outdoor workers (due to prolonged exposure and, in some cases, heavy physical exertion)
- The homeless (due to prolonged exposure and inadequate protection from the elements—both the New York City Heat and Winter Weather Emergency Plans include strategies for outreach to the homeless population)

Secondary impacts to the population may result from power outages brought on by the heat (see Built Environment, below). Additionally, people who rely on prescription medications are at increased risk if pharmacies are out of service due to an outage.

ii. Built Environment

A large portion of New York City's utility and transportation infrastructure is vulnerable to damage during extreme heat and cold events. Although buildings in New York City are generally not as susceptible, long-term exposure to extreme temperatures can cause damage to certain types of older, less heat- or cold-resistant building materials.

Extreme Heat

Extreme heat can cause railroad tracks and pavement on roads and bridges to crack or buckle, resulting in service disruptions and potentially hazardous travel conditions.

When temperatures rise above 90°F during summer months, demand for electricity also rises as people increase their usage of air conditioners and fans. The heat itself can also cause transmission lines to sag, overheat, or short out. This combination of factors stresses the electrical generation, transmission, and distribution infrastructure, which in turn increases the likelihood that sections or components of the electrical system will fail, causing power outages. Such outages may impair building functions such as air conditioning and refrigeration of food and certain types of medications. Increased power demand may also result in higher emissions of greenhouse gases from power-generating facilities, contributing to climate change.

Some people illegally open fire hydrants for use as sprinklers during hot weather. The resulting drop in system water pressure can reduce firefighting capabilities and create potentially life-threatening situations for the public. Hydrant spray caps reduce the discharge of open hydrants from approximately 1,000 gallons per minute to 25 gallons per minute. The New York City Fire Department (FDNY) distributes hydrant spray caps to the public to prevent water waste.

Extreme Cold

During the winter months, freezing temperatures and repeated freeze-thaw cycles can cause potholes, which may damage vehicles. Hazardous travel conditions may result if potholes are not tended to immediately. Frozen pipes, a common occurrence during extreme cold events, may cause service interruptions in water

supply, gas supply, and drainage. To limit these effects, utility providers monitor conditions, perform routine maintenance, and address problems as they arise. Additionally, when the temperature falls below 25°F for a 24-hour period, FDNY institutes a hydrant inspection program and takes corrective action to thaw frozen hydrants.

iii. Natural Environment

Extreme temperatures are naturally occurring weather events (human activities and the built environment exacerbate the problem, but do not cause it). Thus, it is difficult to determine whether or not the temperatures themselves have any direct impacts on the natural environment. There can, however, be impacts on the natural environment that are related to secondary hazards associated with extreme heat events, such as poor air quality and drought. Extreme temperatures, particularly heat, also cause an increase in energy usage, which contributes to higher emissions of pollutants and greenhouse gases during these periods. Long-term temperature changes may cause shifts in habitat and, potentially, extinctions of certain types of local species which are not adapted to long stretches of extreme heat or cold. However, it is still uncertain what impacts short-duration extreme temperature events have, if any.

iv. Future Environment

Scientists predict that extreme heat events in New York City will increase in frequency, intensity, and duration in the future, while extreme cold events will decrease in frequency, intensity, and duration. Table 3.10.49, adapted from the NPCC, illustrates this projected change through the middle of the 21st century. These projections are relative to the baseline period of 1971-2000, and include a middle-range estimate (25th-75th percentile) and a high-value estimate (90th percentile). According to these projections, New York City should expect, on average, up to an additional 8 to 15 days at 90°F or above by the 2020s, and up to an additional 21 to 39 days at 90°F or above by the 2050s (which would represent more than a 100% increase).

Furthermore, up to one to two additional heat waves per year are projected by the 2020s, and up to three to five additional heat waves per year are projected by the 2050s. These heat waves are expected to last one to two days longer on average. As the climate warms, extreme heat events are also expected to become more common during peripheral summer months like May and September.

Extreme cold events, on the other hand, are expected to decrease. The annual average number of days with minimum temperatures below 32°F is expected to decrease by 12 to 20 days by the 2020s and 20 to 30 days by the 2050s.

The combination of more heat waves and changing demographics (such as the growth of the elderly population) is likely to result in higher rates of temperature-related mortality and illness in the future. A recent study (Li et al. 2013) projects that the number of heat-related deaths in Manhattan will increase at a relatively sharp rate throughout the 21st century while cold-related deaths will decrease at a more modest rate, resulting in a net increase in total mortality related to extreme temperatures. Relative to the 1980s, the study predicts a 37% to 49% increase in heat-related deaths and an 11% to 15% increase in temperature-related deaths by mid-century. By the end of the century, heat-related deaths are predicted to increase 50% to 91%, while total temperature-related deaths are expected to increase 16% to 31%.

Table 3.10.49: Quantitative Changes in Extreme Temperature Events (Source: NPCC, 2013)

		2020s		2050s	
Heat Waves and Cold Events	**Baseline (1971-2000)**	**Middle Range (25th-75th percentage)**	**High End (90th percentile)**	**Middle Range (25th-75th percentage)**	**High End (90th percentage)**
Number of days per year at or above 90°F	18	26 to 31	33	39 to 52	57
Number of heat waves per year	2	3 to 4	4	5 to 7	7
Average duration (days)	4	5	5	5 to 6	6
Number of days below 32°F	72	52 to 58	60	42 to 48	52

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