5.4.4 Extreme Temperatures

This section provides a profile and vulnerability assessment of the extreme temperatures hazard for Monroe County.

5.4.4.1 Hazard Profile

This section provides information regarding the description, extent, location, previous occurrences and losses, climate change projections, and the probability of future occurrences for the extreme temperatures hazard.

Description

Extreme temperature includes both heat and cold events, which can have a significant impact to human health, commercial/agricultural businesses, and primary and secondary effects on infrastructure (such as burst pipes and power failure). What constitutes "extreme cold" or "extreme heat" can vary across different areas of the country, based on the population's experience.

Extreme Cold

Extreme cold events occur when temperatures drop well below normal in an area. For example, near-freezing temperatures are considered "extreme cold" in regions relatively unaccustomed to winter weather. Conversely, "extreme cold" might be used to describe temperatures below 0° F in regions that are subjected to temperatures below freezing on more of a regular basis. For the purposes of this HMP, extreme cold temperatures are characterized when the ambient air temperature drops to approximately 0 degrees Fahrenheit (ºF) or below (National Weather Service n.d.). Extensive exposure to extreme cold temperatures can cause frostbite or hypothermia and can become life-threatening. Extreme cold also can cause emergencies in susceptible populations, such as those without shelter, those who are stranded, or those who live in a home that is poorly insulated or without heat (such as mobile homes). Infants and the elderly are most susceptible to the effects of extreme changes in temperatures and are particularly at risk, but anyone can be affected (Center for Disease Control and Prevention [CDC] 2012).

In New York State, extreme cold days are defined to reflect the State's regional climate variations. Extreme cold days in the State are individual days with minimum temperatures at or below 32° F or individual days with minimum temperatures at or below 0°F (NYSERDA 2014).

Several health hazards are related to extreme cold temperatures and include wind chill, frostbite, and hypothermia.

- *Wind chill* is not the actual temperature but rather how wind and cold feel on exposed skin. As the wind increases, heat is carried away from the body at an accelerated rate, driving down the body temperature.
- *Frostbite* is damage to body tissue caused by extreme cold. A wind chill of -20°F will cause frostbite in just 30 minutes. Frostbite can cause a loss of feeling and a white or pale appearance in extremities.
- *Hypothermia* is a condition brought on when the body temperature drops to less than 95°F, and it can be deadly. Warning signs of hypothermia include uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness, and apparent exhaustion

Extreme Heat

Extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for a region and that last for several weeks (Center for Disease Control and Prevention [CDC] 2012). Humid or muggy conditions occur when a "dome" of high atmospheric pressure traps hazy, damp air near the ground. A

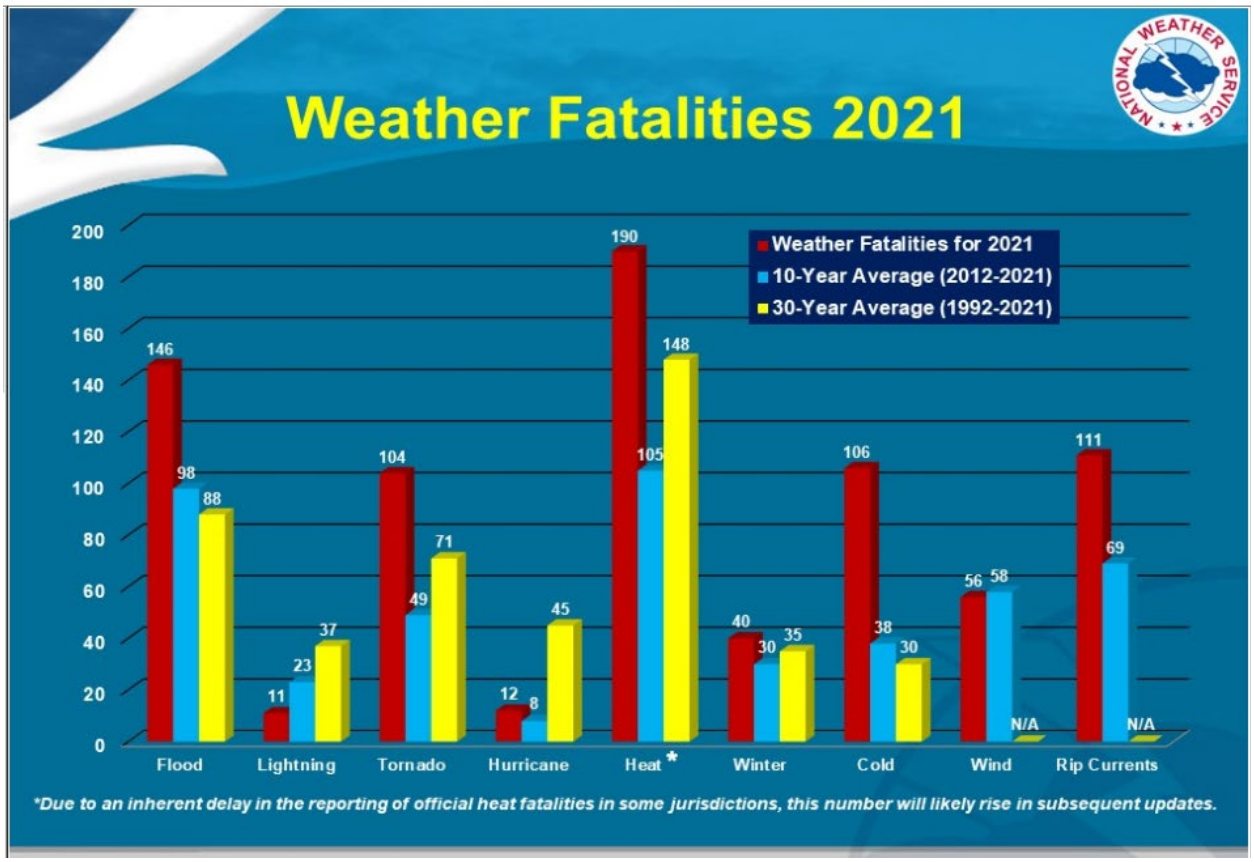
heat wave is a period of abnormally and uncomfortably hot and unusually humid weather. A heat wave will typically last two or more days (NOAA 2009).

In New York State, high temperatures and heat waves are defined in several ways to reflect the diversity of conditions experienced across the State. Extreme hot days in New York State are defined as individual days with maximum temperatures at or above 90° F or 95°F. Heat waves are defined as three consecutive days with maximum temperatures above 90° F (NYSERDA 2014).

Depending on severity, duration, and location; extreme heat events can create or provoke secondary hazards including, but not limited to, dust storms, droughts, wildfires, water shortages, and power outages. These secondary hazards could result in a broad and far-reaching set of impacts throughout a local area or an entire region. Impacts could include significant loss of life and illness; economic costs in transportation, agriculture, production, energy, and infrastructure; and losses of ecosystems, wildlife habitats, and water resources (NYS DHSES 2019).

Extreme heat is the number one weather-related cause of death in the U.S. On average, nearly 150 people die each year in the United States from excessive heat (NWS 2021). Figure 5.4.4-1 shows the number of weather fatalities based on a 10-year average and a 30-year average. Heat caused the highest average of weather-related fatalities between 2012 and 2021.

Figure 5.4.4-1. Average Number of Weather-Related Fatalities in the U.S.



Source: NWS 2021

Extent

Extreme Cold

The extent (severity or magnitude) of extreme cold temperatures is generally measured through the Wind Chill Temperature (WCT) Index. The index uses advances in science, technology, and computer modeling to provide an accurate, understandable, and useful formula for calculating the dangers from wind chill. For details regarding the WCT, refer to: Winter (weather.gov). The WCT is presented in Figure 5.4.4-2.

Figure 5.4.4-2. Wind Chill Index

Wind (mph) \ Temperature (°F)	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

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

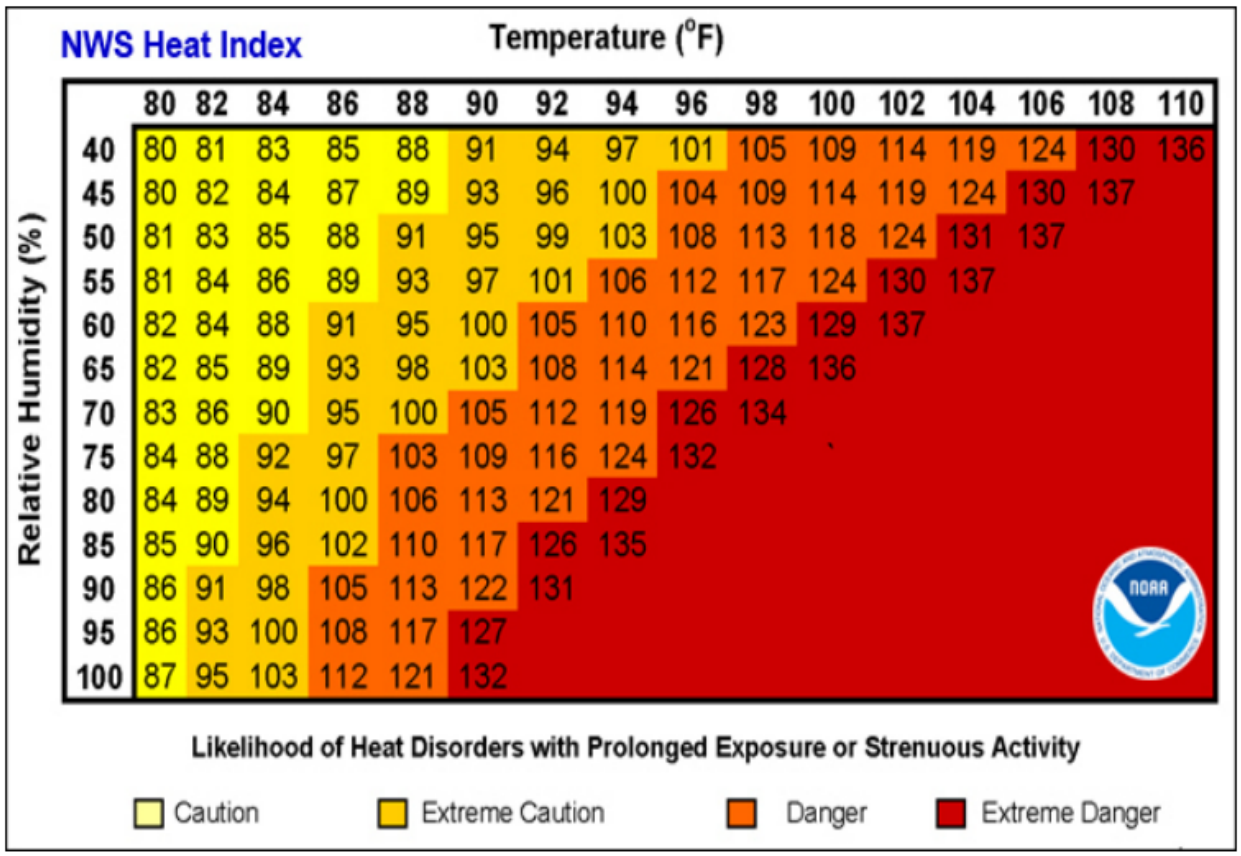
Where, T= Air Temperature (°F) V= Wind Speed (mph) *Effective 11/01/01*

Source: NWS 2001

Extreme Heat

The extent of extreme heat temperatures is generally measured through the Heat Index, identified in Figure 5.4.4-3. Created by the NWS, the Heat Index is a chart that accurately measures apparent temperature of the air as it increases with the relative humidity. The temperature and relative humidity are needed to determine the Heat Index. Once both values have been identified, the Heat Index is the corresponding number of both values (as seen in Figure 5.4.4-3). This index provides a measure of how temperatures actually feel; however, the values are devised for shady, light wind conditions. Figure 5.4.4-3 shows the heat index value for shaded areas. Exposure to full sun can increase the index by up to 15 degrees (NYSDHSES n.d.).

Figure 5.4.4-3. NWS Heat Index Chart – Shaded Areas



Source: NWS

Table 5.4.4-1 describes the adverse effects of prolonged exposure to direct sunlight on an individual.

Table 5.4.4-1. Adverse Effects of Prolonged Exposure to Direct Sunlight

Category	Heat Index	Effects on the Body
Caution	80°F - 90°F	Fatigue possible with prolonged exposure and/or physical activity
Extreme Caution	90°F - 103°F	Heat stroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity
Danger	103°F - 124°F	Heat cramps or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity
Extreme Danger	125°F or higher	Heat stroke highly likely

Source: NWS

The National Weather Service (NWS) provides alerts when Heat Indices approach hazardous levels. Table 5.4.4-2 explains these alerts. In the event of 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

- Provides assistance to state and local health officials in preparing Civil Emergency Messages in severe heat waves (NYSDHSES n.d.).

Table 5.4.4-2. National Weather Service Alerts

Alert	Criteria
Heat Advisory	Issued 12 hours of the onset of the following conditions: maximum daytime heat index values are to reach between 100°F to 104°F for at least 2 consecutive hours
Excessive Heat Watch	Issued when conditions are favorable for excessive heat in the next 24 to 72 hours
Excessive Heat Warning	Issued within 12 hours of the onset of the following conditions: maximum heat index temperature is expected to be 105°F or higher for at least 2 days and nighttime air temperatures will not drop below 75°F

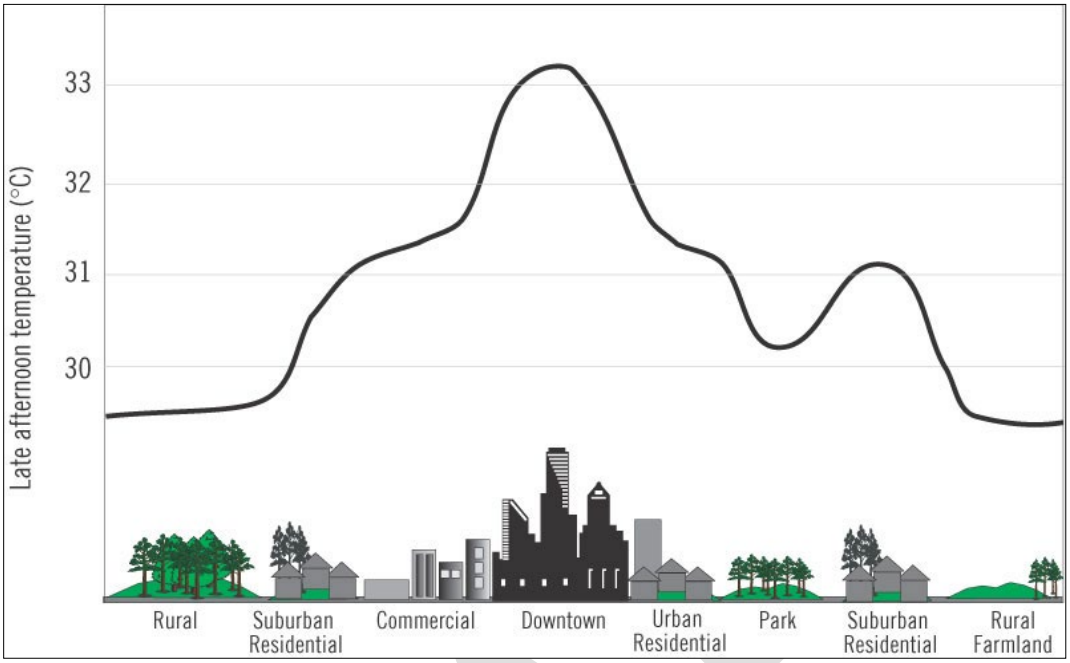
Source: NYSDHSES n.d.

Urbanized areas and urbanization create an exacerbated type of risk during an extreme heat event, compared to rural and suburban areas. As these urban areas develop and change, so does the landscape. Buildings, roads, and other infrastructure replace open land and vegetation. Surfaces that were once permeable and moist are now impermeable and dry. These changes cause urban areas to become warmer than the surrounding areas. This forms an 'island' of higher temperatures (EPA 2022). The City of Rochester is the main urban area within Monroe County.

The term 'heat island' describes built-up areas that are hotter than nearby rural areas. The annual mean air temperature of a city with more than 1 million people can be between 1.8 ºF and 5.4ºF warmer than its surrounding areas. In the evening, the difference in air temperatures can be as high as 22ºF. Heat islands occur on the surface and in the atmosphere. On a hot, sunny day, the sun can heat dry, exposed urban surfaces to temperatures 50ºF to 90ºF hotter than the air. Heat islands can affect communities by increasing peak energy demand during the summer; thereby escalating air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and death, and water quality degradation (EPA 2022).

Figure 5.4.4-4 below illustrates an urban heat island profile. The graphic demonstrates that heat islands are typically most intense over dense urban areas. Further, vegetation and parks within a downtown area may help reduce heat islands (U.S. EPA 2019).

Figure 5.4.4-4. Urban Heat Island Profile

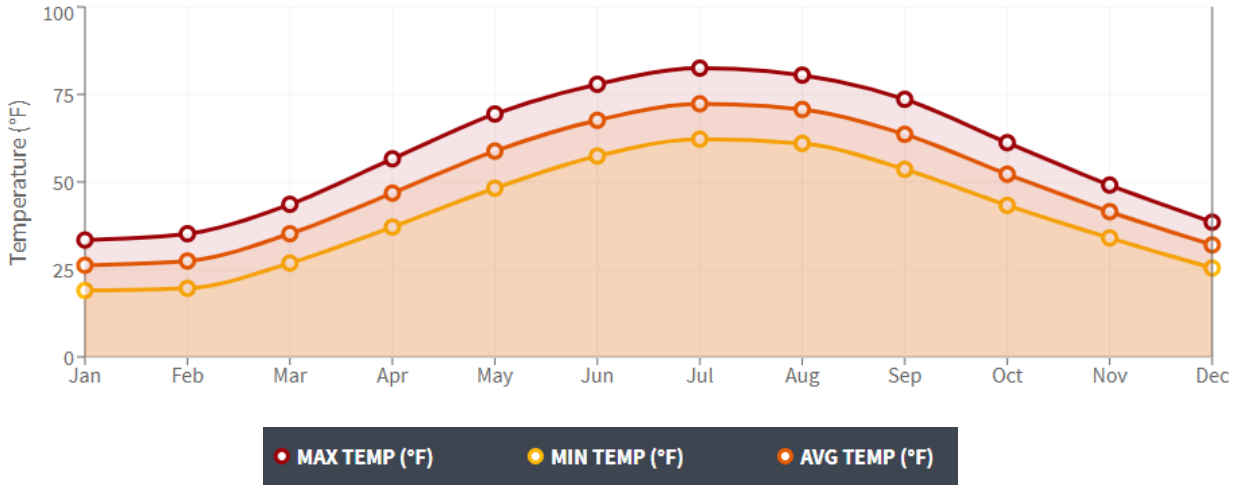


Source: EPA 2019
ºC degrees Celsius

Location

Varying land elevations, character of the landscape, and proximity to large bodies of water play a significant role in the state's temperatures. Monroe County is susceptible to both extreme cold and extreme heat temperature events. Figure 5.4.4-5 shows the average low and high temperatures each month at the Rochester International Airport station located in Monroe County.

Figure 5.4.4-5. Average Temperatures at Rochester International Airport



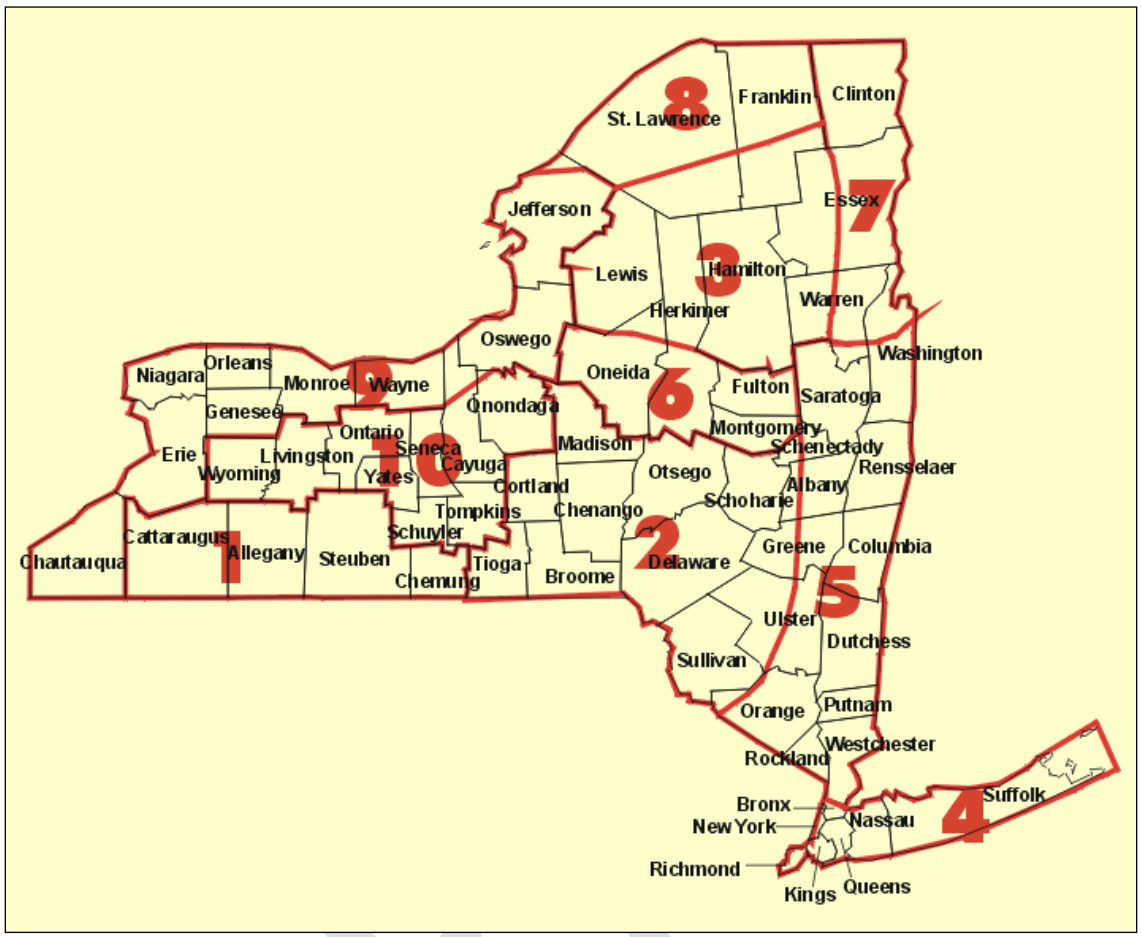
Source: NOAA NCEI 2020

Extensive periods of extreme cold temperatures are a result from movement of great high-pressure systems into and through the eastern United States. Under higher-than-normal atmospheric pressures when arctic air masses are present, extreme winter temperatures hover over New York. New York State's location in the northeast makes it highly susceptible to extreme cold that can cause impact to human life and property (NYS DHSES 2019). Extreme cold temperatures occur throughout most of the winter season and generally accompany most winter storm events throughout the state. The NYSC Office of Cornell University indicates that cold temperatures prevail over the state whenever arctic air masses, under high barometric pressure, flow southward from central Canada or from Hudson Bay (Cornell University n.d.).

Excessive heat can occur anywhere, and occurrences of excessive heat are generally widespread and will cover an entire county. However, there can be spot locations that are somewhat cooler (e.g., a shady park near a stream) or hotter (e.g., urban areas because of their built environment holds the heat) (NYS DHSES 2019). Extreme heat temperatures of varying degrees exist throughout the state for most of the summer season, except for areas with high altitudes (Cornell University n.d.).

New York State is divided into 10 climate divisions: Western Plateau, Eastern Plateau (Catskill Mountains), Northern Plateau (Adirondack Mountains), Coastal, Hudson Valley, Mohawk Valley, Champlain Valley, St. Lawrence Valley, Great Lakes, and Central Lakes. According to NCDC, "Climatic divisions are regions within each state that have been determined to be reasonably climatically homogeneous" (NOAA 2012). Monroe County is located within the Great Lakes Division (Division 9). Figure 5.4.4-6 depicts the climate divisions in New York State.

Figure 5.4.4-6. New York State Climate Divisions



Source: NOAA 2012
Notes: (1) Western Plateau; (2) Eastern Plateau (Catskill Mountains); (3) Northern Plateau (Adirondack Mountains); (4) Coastal; (5) Hudson Valley; (6) Mohawk Valley; (7) Champlain Valley; (8) St. Lawrence Valley; (9) Great Lakes; and (10) Central Lakes

Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with extreme temperatures throughout New York State and Monroe County. With so many sources reviewed for this HMP, loss and impact information for many events could vary. Therefore, the accuracy of monetary figures discussed is based only on the available information in cited sources.

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2022, New York State and Monroe County were not included in any FEMA-declared extreme temperature specific disasters (DR) or emergency declarations (EM). However, Monroe County has been included in numerous declarations that involved severe winter storms. Refer to Section 5.4.10 (Severe Winter Storm) for more information on these declarations.

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties

that are contiguous to a designated county. Between 2015 and 2022, Monroe County was included in the following USDA-designated agricultural disasters that included or may have included losses due to extreme temperatures:

- S4023 - 2015 Heat, Excessive Heat
- S4031 - 2015 Heat Excessive Heat
- S4037 - 2015 Heat, Excessive Heat
- S4052 - 2015 Frost, Freeze
- S4903 - 2020 Frost, Freeze
- S4904 - 2020 Frost, Freeze

The USDA crop loss data provide another indicator of the severity of previous events. Additionally, crop losses can have a significant impact on the economy by reducing produce sales and purchases. Such impacts may have long-term consequences, particularly if crop yields are low the following years as well. USDA records indicate that Monroe County has experienced crop losses from extreme temperature events. Table 5.4.4-3. provides details regarding crop losses in Monroe County according to USDA records.

Table 5.4.4-3. USDA Crop Losses from Excess Moisture/Precipitation/Rain and/or Flooding in Monroe County (2015-2022)

Year	Crop Type	Cause of Loss	Losses
2020	Sweet Corn, Green Peas, Soybean	Heat	$98k
2020	Apples, Soybeans	Frost/Freeze	$180k

Source: USDA 2022
Note: Cold Wet Weather is not included in the values above.

Previous Events

Table 5.4.4-4. identifies the known extreme temperature events that impacted Monroe County between 2015 and 2022. For events prior to 2015, refer to Appendix E (Supplementary Data). For detailed information on damages and impacts to each municipality, refer to Section 9 (Jurisdictional Annexes).

Table 5.4.4-4. Extreme Temperature Events in Monroe County, 2015 to 2022

Dates of Event	Event Type	Location	FEMA Declaration Number	County Designated?	Losses / Impacts
October 17, 2018	Frost/Freeze	Monroe County	N/A	N/A	Widespread freezing temperatures occurred in most of the area to start the day. This resulted in a killing freeze or end of the growing season in most counties. This included 31° F in Spencerport.
January 1–31, 2019	Extreme Cold/Wind Chill	Monroe County	N/A	N/A	Behind the front that caused widespread blowing and drifting snow across the area with localized blizzard conditions in Buffalo and Watertown, temperatures dipped below zero in the entirety of the area. This combined with wind gusts of 35 to 50 mph dropped wind chills substantially below zero. One homeless man died of exposure in Williamsville during the cold outbreak that closed almost all area schools and churches. Some of the recorded lowest wind chills during the period were, -25° F in Irondequoit,.
May 5, 2020	Frost/Freeze	Monroe County	N/A	N/A	A very cold pattern persisted from April into the growing season across most of the northeastern United States. This allowed for widespread accumulating snows periodically along with unseasonable cold temperatures to persist through the first half of May. Widespread freezing temperatures were present overnight in much of the area on several nights as the first few weeks of the growing season started. Selected morning low temperatures included 29° F in Rochester
May 8–14, 2020	Frost/Freeze	Monroe County	N/A	N/A	A very cold pattern persisted from April into the growing season across most of the northeastern United States. This allowed for widespread accumulating snows periodically along with unseasonable cold temperatures to persist through the first half of May. Widespread freezing temperatures were present overnight in much of the area on several nights as the first few weeks of the growing season started.

Source: NOAA NCEI 2022; FEMA 2022

Climate Change Impacts

Climate change is beginning to affect both people and resources in New York State, and these impacts are projected to continue growing. Impacts related to increasing temperatures and heavier precipitation are already being felt in the state. ClimAID: the Integrated Assessment for Effective Climate Change in New York State (ClimAID) was undertaken to provide decision makers with information on the state's vulnerability to climate change and to facilitate the development of adaptation strategies informed by both local experience and scientific knowledge (NYSERDA 2014).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change, Monroe County is part of Region 1 (Western New York and the Great Lakes Plain). In Region 1, it is estimated that temperatures will increase by 4.3ºF to 6.3ºF by the 2050s and 5.7ºF to 9.6ºF by the 2080s (baseline of 47.7ºF). Average annual temperatures are projected to increase across New York State by 2° F to 3.4° F by the 2020s, 4.1° F to 6.8° F by the 2050s, and 5.3° F to 10.1° F by the 2080s with an average rate of warming over the past century of 0.25° F per decade. By the end of the century, the greatest warming is projected to be in the northern section of the State.

Extreme events are also projected to increase, as illustrated in Table 5.4.4-5 below (NYSERDA 2014).

Table 5.4.4-5. Extreme Event Projections for Region 1

Event Type (2020s)	Low Estimate (10th Percentile)	Middle Range (25th to 75th Percentile)	High Estimate (90th Percentile)
Days over 90 °F (8 days)	12	14 to 17	19
# Of Heat Waves (0.7 heat waves)	2	2 to 2	2
Duration of Heat Wave (4 days)	4	4 to 4	4
Days below 32 °F (133 days)	99	103 to 111	116
Days over 1" Rainfall (5 days)	4	5 to 5	6
Days over 2" Rainfall (0.6 days)	0.6	0.6 to 0.7	0.8

Source: NYSERDA 2014

Probability of Future Occurrences

Based on the historic and more recent extreme temperature events in Monroe County, and the future climate projections for this region, the County has a moderate probability of future extreme temperature events. It is anticipated that Monroe County will continue to experience direct and indirect impacts of extreme temperature events annually that may induce secondary hazards such as infrastructure deterioration or failure, utility failures, power outages, etc. Additionally, climate change is expected to increase the severity and frequency of extreme heat events in Monroe County. According to available record-keeping, Monroe County has a 100-percent annual chance of occurrence of extreme temperature events (heat or cold) in any given year.

Table 5.4.4-6. Probability of Future Occurrence of Extreme Temperature Events

Hazard Type	Number of Occurrences Between 1900 and 2022	% chance of occurrence in any given year
Extreme Heat (days with maximum temperature ≥ 95°F or greater)	98	76.6%
Extreme Cold (days with minimum temperatures ≤ 0°F	506	100%
TOTAL	**604**	**100%**

Source: Midwestern Regional Climate Center 2022; FEMA 2022

Note: Disaster occurrences include federally declared disasters and selected extreme temperature events between January 1, 1996, and January 1, 2022. Due to limitations in data, not all extreme temperature events occurring between 1996 and June 2022 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

Section 5.3 ranks the identified hazards of concern for Monroe County. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Steering Committee, the probability of occurrence of extreme temperature in the County is considered 'occasional' (between 10 and 100 percent annual probability of a hazard event occurring, as presented in Table 5.3-2.).

5.4.4.2 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the hazard area identified. The entire County has been identified as exposed for the extreme temperature events. Therefore, all assets in the County (population, structures, critical facilities, and lifelines), as described in the County Profile (Section 4), are exposed and potentially vulnerable. The following text evaluates and estimates the potential impact of extreme temperatures on Monroe County, including:

- Impact on Life, Health, and Safety
- Impact on General Building Stock
- Impact on Critical Facilities
- Impact on Economy
- Impact on the Environment
- Cascading Impacts on Other Hazards
- Future Changes That May Impact Vulnerability
- Change of Vulnerability Since the 2017 HMP

Impact on Life, Health and Safety

Extreme temperature events have potential health impacts including injury and death. According to the Centers for Disease Control and Prevention, populations most at risk to extreme cold and heat events include the following: (1) the elderly, who are less able to withstand temperatures extremes because of their age, health conditions, and limited mobility to access shelters; (2) infants and children up to 4 years of age; (3) individuals who are physically ill (such as with heart disease or high blood pressure), (4) low-income persons who cannot afford proper heating and cooling; and (5) members of the general public who may overexert during work or exercise during extreme heat events or experience hypothermia during extreme cold events (CDC 2006).

> According to NOAA's 2001 Winter Storms The Deceptive Killers, approximately 50 percent of the deaths related to extreme cold temperatures happen to people over 60 years old, more than 75 percent of those deaths are male, and about 20 percent occur in the home (NYS DHSES 2014).

The entire population of Monroe County is exposed to extreme temperature events. According to the 2020 U.S. Census, the County had a population of 753,109. Refer to Section 4 (County Profile) for a summary of population statistics for the county.

Impact on General Building Stock

Extreme heat generally does not affect buildings; however, losses may be associated with overheating of heating, ventilation, and air conditioning (HVAC) systems. Extreme cold temperature events can damage buildings through freezing and bursting pipes and freeze/thaw cycles. Additionally, manufactured homes (mobile homes) and antiquated or poorly constructed facilities may have inadequate capabilities to withstand extreme temperatures.

All of the building stock in the County is exposed to the extreme temperature hazard; however, direct impacts are expected to be minimal. Refer to Section 4 (County Profile), which summarizes the building inventory in Monroe County.

Impact on Critical Facilities

Similar to the general building stock, all critical facilities in the County are exposed to the extreme temperature hazard; however, direct impacts are expected to be minimal. Impacts to critical facilities are the same as were described for general building stock. Additionally, it is essential that critical facilities remain operational during natural hazard events. Extreme heat events can sometimes cause short periods of utility failures, commonly referred to as "brown-outs," created by increased usage from air conditioners, appliances, and similar equipment. Similarly, heavy snowfall and ice storms, associated with extreme cold temperature events, can interrupt power as well. Backup power is recommended for critical facilities and infrastructure.

Impact on Economy

Extreme temperature events also have impacts on the economy, including loss of business function and damage and loss of inventory. Business owners may be faced with increased financial burdens due to unexpected repairs caused to the building (pipes bursting), higher than normal utility bills, or business interruption caused by power failure (loss of electricity and telecommunications).

The agricultural industry is most at risk in terms of economic impact and damage caused by extreme temperature events. Extreme heat events can result in drought and dry conditions and directly affect livestock and crop production.

Based on the 2017 Census of Agriculture, 527 farms were present in Monroe County, encompassing 106,778 acres of total farmland. The average farm size was 203 acres. Monroe County farms had a total market value of products sold of $76.64 million, averaging $145,433 per farm (USDA 2017). Table 5.4.4-7 lists the acreage of agricultural land exposed to extreme temperature hazards.

Table 5.4.4-7. Agricultural Land in Monroe County in 2017

Number of Farms	Land in Farms (acres)	Total Cropland (acres)	Total Pastureland (acres)	Acres Irrigated
527	106,778	85,422	4,271	639

Source: USDA 2017

In 2017, the top three agricultural products sold in Monroe County were grains, oilseeds, dry beans, and dry peas at $26 million; vegetables, melons, potatoes, and sweet potatoes at $19.7 million; and nursery, greenhouse, floriculture, and sod at $11.9 million. Monroe County was the eighth highest-ranked County in the State for its sales of cut Christmas trees and short rotation woody crops, and sixth highest ranked for its total acreage of crop items for all harvested vegetables (USDA 2017).

If an extreme temperature event impacted 40 percent of the agricultural products sold from Monroe County farms, based on 2017 market values, this would be a loss of $30.6 million. This figure does not include how the tourism industry and local jobs are impacted.

Impact on the Environment

Extreme temperature events can have a major impact on the environment. For example, freezing and warming weather patterns create changes in natural processes. An excess amount of snowfall and earlier warming periods may affect natural processes such as flow within water resources (USGS 2020). Extreme heat events can have

particularly negative impacts on aquatic systems, contributing to fish kills, aquatic plant die offs, and increased likelihood of harmful algal blooms.

Cascading Impacts On Other Hazards

Extreme heat temperature events can exacerbate the drought hazard, increase the potential risk of wildfires, and escalate severe storm and severe winter weather events for the County. For example, extreme heat events may accelerate evaporation rates, drying out the air and soils. Extreme heat can also dry out terrestrial species, making them more susceptible to catching fire. Extreme variation in temperatures could create ideal atmospheric conditions for severe storms or worsen the outcome of severe winter weather during freezing and thawing periods. Refer to Section 5.4.9 (Severe Storm), Section 5.4.10 (Severe Winter Storm), and Section 5.4.11 (Wildfire) for more information about these hazards of concern.

Future Changes That May Impact Vulnerability

Understanding future changes that impact vulnerability in the County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The county considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in the population
- Other identified conditions as relevant and appropriate, including the impacts of climate change

Projected Development

The ability of new development to withstand extreme temperature impacts can be enhanced through land use practices and consistent enforcement of codes and regulations for new construction. New development will change the landscape where buildings, roads, and other infrastructure potentially replace open land and vegetation. Transformation of pervious surfaces (including vegetation) to impervious surfaces causes an island of higher temperatures. Specific areas of recent and new development are indicated in tabular form and/or on the hazard maps included in the jurisdictional annexes in Volume II, Section 9 (Jurisdictional Annexes) of this plan.

Projected Changes in Population

According to the 2020 Census, the population of the County has increased by approximately 1.2 percent since 2010. The County's population is anticipated to slightly increase over the next decade (0.7 percent increase by 2030). An increase in the population throughout Monroe County will increase the County's risk to extreme temperature events. Refer to section 4 (County Profile), which includes a more thorough discussion about population trends for the County.

Climate Change

As discussed above, most studies project that the State of New York will see an increase in average annual temperatures and precipitation. As the climate warms, extreme cold events might decrease in frequency, while extreme heat events might increase in frequency; the shift in temperatures could also result in hotter extreme heat events. With increased temperatures, vulnerable populations could face increased vulnerability to extreme heat and its associated illnesses, such as heatstroke and cardiovascular and kidney disease. Additionally, as temperatures rise, more buildings, facilities, and infrastructure systems may exceed their ability to cope with the heat.

Change of Vulnerability Since 2017 HMP

Overall, the entire County remains vulnerable to extreme temperatures. As existing development and infrastructure continue to age, they can be at increased risk to failed utility systems (e.g., HVAC) if they are not properly maintained. Similarly, an increase in the elderly population remaining in the County increases the vulnerable population.