5.4.2 Extreme Temperature

This section provides a profile and vulnerability assessment for the extreme temperature hazard.

5.4.2.1 Hazard Profile

This section provides profile information including description, extent, location, previous occurrences and losses and the probability of future occurrences.

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 (e.g., burst pipes and power failure). What constitutes "extreme cold" or "extreme heat" can vary across different areas of the country, based on what the population is accustomed to.

Extreme Cold

Extreme cold events are when temperatures drop well below normal in an area. In regions relatively unaccustomed to winter weather, near freezing temperatures are considered "extreme cold." Extreme cold temperatures are characterized by the ambient air temperature dropping to approximately 0 degrees Fahrenheit (ºF) or below (National Weather Service [NWS], 2013).

Exposure to cold temperatures, whether indoors or outside, can lead to serious or life-threatening health problems such as hypothermia, cold stress, frostbite or freezing of the exposed extremities such as fingers, toes, nose and ear lobes. Hypothermia occurs when the core body temperature is <95ºF. If persons exposed to excessive cold are unable to generate enough heat (e.g., through shivering) to maintain a normal core body temperature of 98.6ºF, their organs (e.g., brain, heart, or kidneys) can malfunction. When brain function deteriorates, persons with hypothermia are less likely to perceive the need to seek shelter. Signs and symptoms of hypothermia (e.g., lethargy, weakness, loss of coordination, confusion, or uncontrollable shivering) can increase in severity as the body's core temperature drops. 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 particularly at risk, but anyone can be affected (Centers of Disease Control and Prevention [CDC], 2009).

Extremely cold temperatures often accompany a winter storm, so individuals may have to cope with power failures and icy roads. Although staying indoors as much as possible can help reduce the risk of car crashes and falls on the ice, individuals may also face indoor hazards. Many homes will be too cold—either due to a power failure or because the heating system is not adequate for the weather. The use of space heaters and fireplaces to keep warm increases the risk of household fires and carbon monoxide poisoning.

During cold months, carbon monoxide may be high in some areas because the colder weather makes it difficult for car emission control systems to operate effectively. Carbon monoxide levels are typically higher during cold weather because the cold temperatures make combustion less complete and cause inversions that trap pollutants close to the ground (USEPA, 2013).

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 0° F (NYSERDA 2014).

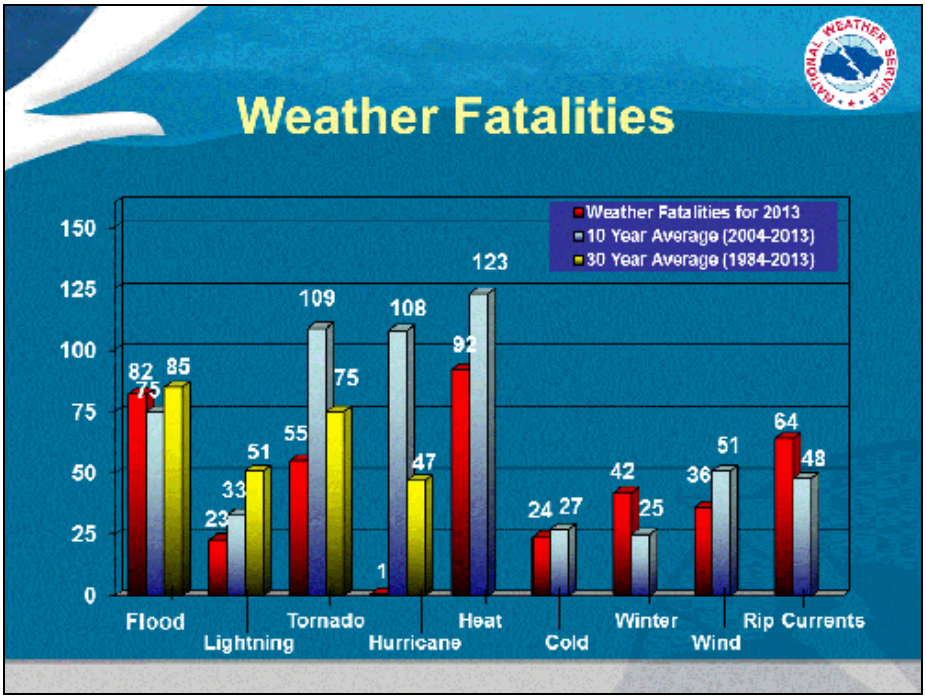
Extreme Heat

Temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks are defined as extreme heat (CDC, 2009). An extended period of extreme heat of three or more consecutive days is typically called a heat wave and is often accompanied by high humidity (NWS, 2013). There is no universal definition of a heat wave because the term is relative to the usual weather in a particular area. The term heat wave is applied both to routine weather variations and to extraordinary spells of heat which may occur only once a century (Meehl and Tebaldi, 2004). A basic definition of a heat wave implies that it is an extended period of unusually high atmosphere-related heat stress, which causes temporary modifications in lifestyle and which may have adverse health consequences for the affected population (Robinson, 2000). 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 at or above 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 (CDC, 2009). This could result in a broad and far-reaching set of impacts throughout a local area or 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 (Adams, Date Unknown; Meehl and Tebaldi, 2004; CDC, 2009; NYS DHSES, 2011).

Extreme heat is the number one weather-related cause of death in the U.S. On average; more than 120 people die each year from excessive heat. In 2013, New York State reported 10 heat-related fatalities (NWS, 2014). Figure 5.4.2-1 shows the number of weather fatalities based on a 10 year average and 30 year average. Heat has the highest average of weather related fatalities between 2004 and 2013.

Figure 5.4.2-1. Average Number of Weather Related Fatalities in the U.S.



Source: NWS, 2014

Certain populations are considered vulnerable or at greater risk during extreme heat events. These populations include, but are not limited to the following: the elderly age 65 and older, infants and young children under five years of age, pregnant woman, the homeless or poor, the overweight, and people with mental illnesses, disabilities and chronic diseases (NYS DHSES, 2011).

Extent

Extreme Cold

The extent (severity or magnitude) of extreme cold temperatures are generally measured through the Wind Chill Temperature (WCT) Index. Wind Chill Temperature is the temperature that people and animals feel when outside and it is based on the rate of heat loss from exposed skin by the effects of wind and cold. As the wind increases, the body is cooled at a faster rate causing the skin's temperature to drop (NWS, 2009).

On November 1, 2001, the NWS implemented a new WCT Index. It was designed to more accurately calculate how cold air feels on human skin. Figure 5.4.2-2 shows the new WCT Index. The Index includes a frostbite indicator, showing points where temperature, wind speed and exposure time will produce frostbite to humans. The chart shows three shaded areas of frostbite danger. Each shaded area shows how long a person can be exposed before frostbite develops (NWS, 2009).

Figure 5.4.2-2. NWS 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

Source: NWS, 2009

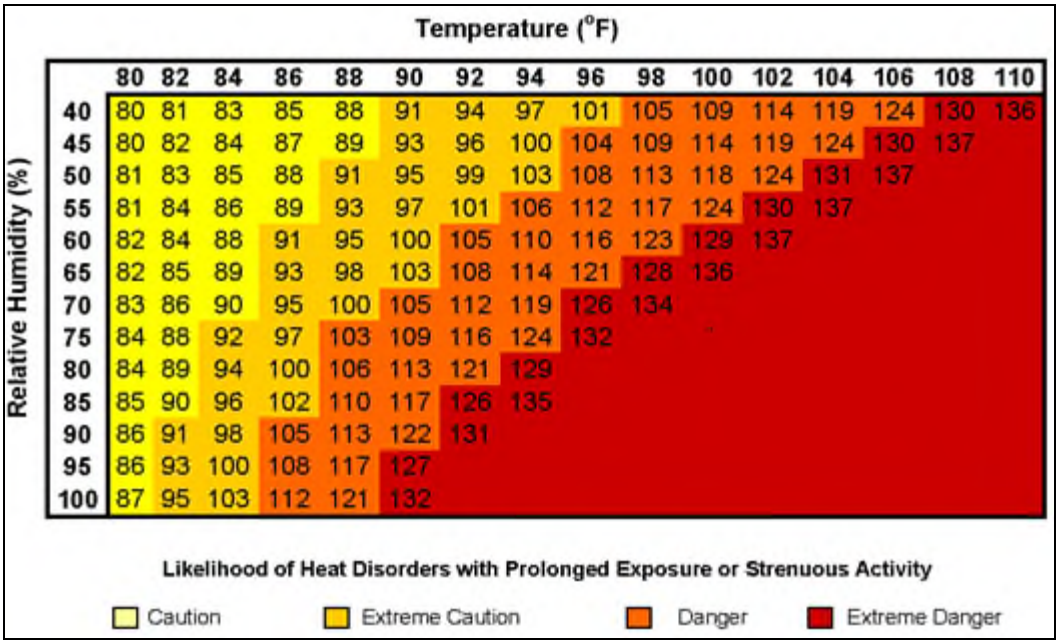
According to the New York State Climate (NYSC) Office of Cornell University, cold winter temperatures prevail over New York State whenever Arctic air masses, under high barometric pressure, flow southward from central Canada or from Hudson Bay. High-pressure systems often move just off the Atlantic coast, become more or less stagnant for several days, and then a persistent airflow from the southwest or south affects the State. This circulation brings the very warm, often humid weather of the summer season and the mild, more pleasant temperatures during the fall, winter, and spring seasons. The highest temperature of record in New York State is 108° at Troy on July 22, 1926. Temperatures of 107° have been observed at Lewiston, Elmira, Poughkeepsie, and New York City. The record coldest temperature is -52° at Stillwater Reservoir (northern Herkimer County) on February 9, 1934 and also at Old Forge (also northern Herkimer County) on

February 18, 1979. Some 30 communities have recorded temperatures of -40° or colder, most of them occurring in the northern one-half of the state and the remainder in the Western Plateau Climate Division and in localities just south of the Mohawk Valley (Cornell University, Date Unknown).

Extreme Heat

The extent of extreme heat temperatures are generally measured through the Heat Index, identified in Table 5.4.2-1. Created by the NWS, the Heat Index is a chart which accurately measures apparent temperature of the air as it increases with the relative humidity. The Heat Index can be used to determine what effects the temperature and humidity can have on the population (NYS DHSES, 2011).

Table 5.4.2-1. Heat Index Chart



Source: NWS, 2013

Table 5.4.2-2 describes the adverse effects that prolonged exposure to heat and humidity can have on an individual.

Table 5.4.2-2. Adverse Effects of Prolonged Exposures to Heat on Individuals

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 exhaustions possible with prolonged exposure and/or physical activity.
Caution	80 °F – 90 °F	Fatigue possible with prolonged exposure and/or physical activity.

Source: NYS DHSES, 2011

To determine the Heat Index, one needs to know the temperature and relative humidity. Once both values are known, the Heat Index will be the corresponding number with both values. That number provides a temperature that the body feels. It is important to know that the Heat Index values are devised for shady, light

wind conditions. Exposure to full sunshine can increase the Heat Index by up to 15 degrees (NYS DHSES, 2011).

The National Weather Service (NWS) provides alerts when Heat Indices approach hazardous levels. Table 5.4.2-3 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/local health officials in preparing Civil Emergency Messages in severe heat waves (NYS DHSES, 2014).

Table 5.4.2-3. National Weather Service Alerts

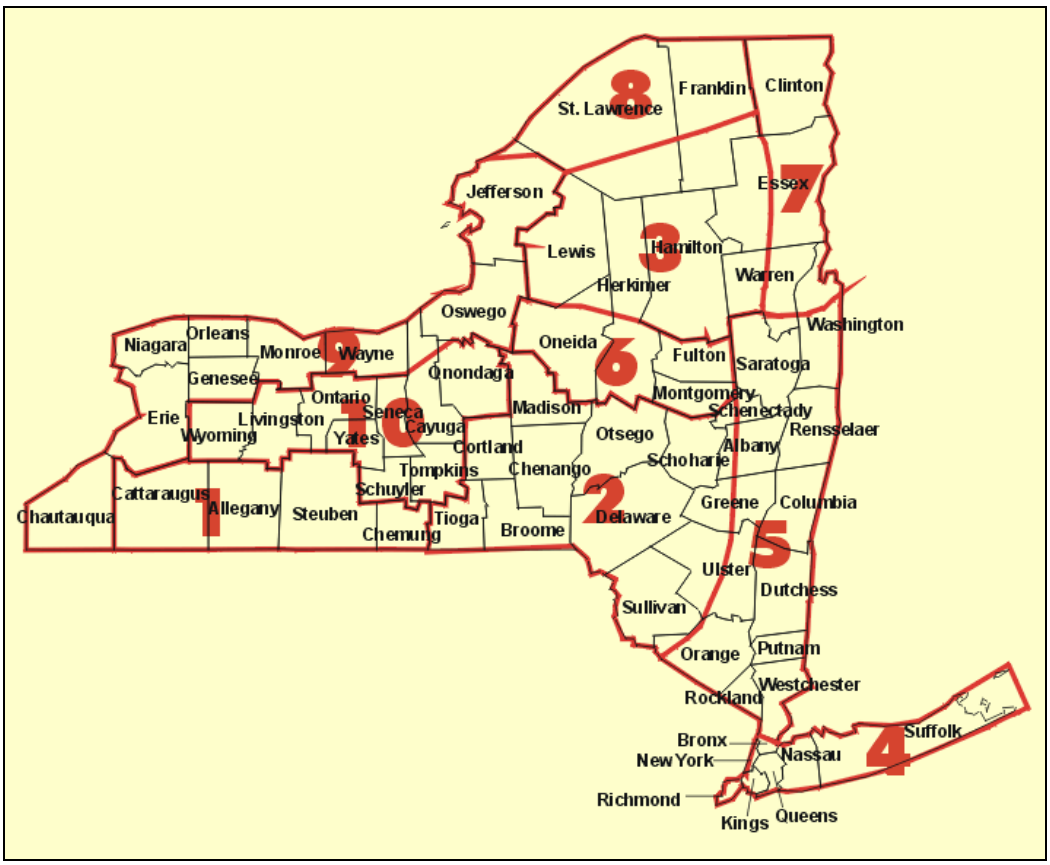
Alert	Criteria
Heat Advisory	Issues 12-24 hours before the onset of the following conditions: heat index of at least 100°F but less than 105°F for at least two hours per day
Excessive Heat Watch	Issued by the NWS when heat indices of 105°F or greater are forecast in the next 24 to 72 hours
Excessive Heat Warning	Issued within 12 hours of the onset of the following criteria: heat index of at least 105°F for more than three hours per day for two consecutive days, or heat index more than 115°F for any period of time

Source: NYS DHSES, 2014

Location

New York State is divided into 10 climate divisions: Western Plateau, Eastern Plateau, Northern Plateau, 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" (CPC, 2005; NCDC, 2012). Putnam County is located within the Hudson Valley Climate Division. Figure 5.4.2-3 depicts the climate divisions in New York State.

Figure 5.4.2-3. New York State Climate Divisions



Source: *CPC, 2005*
Note: *(1) Western Plateau; (2) Eastern Plateau (Catskill Mountains); (3) Northern Plateau (Adirondack Mountains); (4) Coastal; (5) Hudson Valley; (6) Champlain Valley; (7) St. Lawrence Valley; (8) Great Lakes; and (10) Central Lakes.*

Extreme Cold

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, Date Unknown).

Many atmospheric and physiographic controls on the climate result in a considerable variation of temperature conditions over New York State. The average annual mean temperature ranges from about 40°F in the Adirondacks to near 55°F in the New York City area. In January, the average mean temperature is approximately 16°F in the Adirondacks and St. Lawrence Valley, but increases to about 26°F along Lake Erie and in the lower Hudson Valley and to 31°F on Long Island. The record coldest temperature in New York State is -52°F at Stillwater Reservoir (northern Herkimer County) on February 9, 1934. Approximately 30 communities have recorded temperatures of -40°F or colder, most of them occurring in the northern half of New York State and the remainder in the Western Plateau Climate Division and in localities just south of the Mohawk Valley (Cornell University, Date Unknown).

The winters are long and cold in the Plateau Divisions of New York State. In the majority of winter seasons, a temperature of -25°F or lower can be expected in the northern highlands and -15°F or colder in the southwestern and east-central highlands (Cornell University, Date Unknown).

As provided by The Weather Channel, average high and low temperatures during the winter months around Putnam County are identified in Table 5.4.2-4.

Table 5.4.2-4. Average High and Low Temperature Range for Winter Months in Putnam County

Month	Average High	Average Low	Record Low Event(s)
January	34ºF	16ºF	-22ºF in 1994
February	39ºF	19ºF	-11ºF in 1996
March	49ºF	27ºF	-2ºF in 2003
November	51ºF	33ºF	11ºF in 2000
December	39ºF	22ºF	-1ºF in 2004

Source: The Weather Channel, 2014

Extreme Heat

Extreme heat temperatures of varying degrees are existent throughout the State for most of the summer season, except for areas with high altitudes. As provided by The Weather Channel, average high and low temperatures during the summer months around Putnam County are identified in Table 5.4.2-5.

Table 5.4.2-5. Average High and Low Temperature Range for Summer Months in Putnam County

Month	Average High	Average Low	Record High Event(s)
May	72°F	48°F	96°F in 1996
June	78°F	57°F	93°F in 1999
July	83°F	62°F	100°F in 1991
August	81°F	61°F	101°F in 2001
September	74°F	53°F	92°F in 1999

Source: The Weather Channel, 2014

Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with extreme temperatures throughout New York State and Putnam County. With so many sources reviewed for the purpose of 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 identified during research for this HMP.

The Midwest Regional Climate Center (MRCC) operates an online annual temperature extremes database of the Continental U.S., otherwise known as "MRCC Cooperative Observer Station Annual Temperature Record Data Set". The data set contains the annual maximum and minimum temperature records for stations in the U.S. Each station has a cooperative observer system i.d. number (coop number), and those examined for this HMP had a running length of more than five years. In New York State, there are 269 stations that were observed; however, only one station in Putnam County (Town of Carmel). Not every city, town and/or village in New York State contains a station (MRCC, 2012).

There may be some potential problems with the data collected at the stations. The records were created by MRCC at the request of a user. The values of the all-time records for stations with brief histories are limited in accuracy and could vary from nearby stations with longer records. Although the data sets have been through quality control, there is still a need for more resources to quality control extremes. The record sets are for single stations in the cooperative observer network and are limited to the time of operation of each station under one coop number. The records for a place may need to be constructed from several individual station histories. Some of the data may vary from NWS records due to NWS using multiple stations and additional sources like record books (MRCC, Date Unknown). Based on the data provided by MRCC, Table 5.4.2-6 presents the extreme cold (minimum) and hot (maximum) temperature records for Putnam County from 1888 to 2003.

Table 5.4.2-6. MRCC Temperature Extremes – Putnam County

Station ID	Name	Begin	End	Max (oF)	Max Date	Min (oF)	Min Date	Avg Max	Avg Min
301207	Carmel_1_SW	1888	2003	103	7/9/1936	-24	1/22/1961	50.8	29.8

Source: MRCC, 2012
Notes: Begin Year is when the data collection began; End Year is when the data collection stopped.

Between 1954 and 2014, New York State was not included in any major disaster declarations or emergency declarations due to extreme temperatures. Information regarding specific details of temperature extremes in Putnam County is scarce; therefore, previous occurrences and losses associated with extreme temperature events are limited. Table 5.4.2-7 summarizes the extreme temperature events in the County.

Table 5.4.2-7. Extreme Temperature Events between 1950 and 2014

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
July 4-6, 1999	Heat	N/A	N/A	Heat indices reached 110 degrees. 33 people in the New York Metro area were killed; none were in Putnam County.
January 17-18, 2000	Extreme Cold/Wind Chill	N/A	N/A	Wind chills reached -20 to -30 degrees. No injuries or fatalities were reported in Putnam County.
January 21, 2000	Extreme Cold/Wind Chill	N/A	N/A	Wind chills reached -25 to -35 degrees. No injuries or fatalities were reported in Putnam County.
January 27-28, 2000	Extreme Cold/Wind Chill	N/A	N/A	Wind chills reached -25 to -35 degrees. No injuries or fatalities were reported in Putnam County.
August 8-10, 2001	Heat	N/A	N/A	Heat indices across the region peaked at 105 to 110 degrees. Four deaths and one injury were attributed to the heat; none in Putnam County.
July 2-4, 2002	Heat	N/A	N/A	Heat indices across the region peaked at 105 to 110 degrees. No injuries or fatalities were reported in Putnam County.
July 29-31, 2002	Heat	N/A	N/A	Heat indices across the region peaked at 100 to 105 degrees. No injuries or fatalities were reported in Putnam County.
January 15, 2004	Extreme Cold/Wind Chill	N/A	N/A	Wind chills reached as low as -26 degrees throughout the region. No injuries or fatalities were reported in Putnam County.
August 1-3, 2006	Heat	N/A	N/A	Heat indices in the region ranged from 105 to 115 degrees. 42 people died from the heat; none were in Putnam County.
July 22-23, 2011	Heat	N/A	N/A	Heat indices across the region peaked at 115 degrees. 20 people in the New York Metro area were killed; none were in Putnam County.
July 18, 2012	Heat	N/A	N/A	Heat index reached 107 degrees. No injuries or fatalities were reported in Putnam County.
September 11, 2013	Heat	N/A	N/A	Heat index reached 105 degrees. No injuries or fatalities were reported in Putnam County.
January 4, 2014	Extreme Cold	N/A	N/A	A pipe burst in the new County Courthouse.

Source(s): *NOAA-NCDC 2014; Putnam County 2014*
FEMA *Federal Emergency Management Agency*
NOAA-NCDC *National Oceanic Atmospheric Administration – National Climate Data Center*
NYS *New York State*

Agriculture-related disasters are quite common. The Secretary of Agriculture is authorized to designate counties as disaster areas to make emergency loans (EM) to producers suffering losses in those counties and in counties that are contiguous to a designated county. Table 5.4.2-8 presents USDA declared disasters involving extreme temperatures that impacted Putnam County.

Table 5.4.2-8. USDA Declared Disasters

Incidence Period	Event Type	County Designated?*	Losses / Impacts
May 1 – end of crop year 2005	Rain, Flooding, Hail, Winds, Lightning, and Low Temperatures	No (Putnam a contiguous county)	Physical and production losses
May 3-17, 2005	Cold Temperatures, Frost, and Freezes	No (Putnam a contiguous county)	Production losses
April 28 to May 28, 2008	Frost and Freeze	No (Putnam a contiguous county)	Production losses
February 15 to May 12, 2010	Frost, freeze, high winds, hail, excessive snow, excessive rain and cold temperatures	No (Putnam a contiguous county)	Production losses
April 1 to August 30, 2011	Excessive rain, flooding, flash flooding, hail, high winds, below normal temperatures and tornadoes	No (Putnam a contiguous county)	Production losses
July 10 to August 25, 2011	Excessive heat and rain	No (Putnam a contiguous county)	Production losses
March 1, 2012 and continuing	Frosts & Freeze	No (Putnam a contiguous county)	Physical and production losses attributed to frost and freezing temperatures
June 1 to October 24, 2012	Drought and Excessive Heat	Yes	Production losses were attributed to drought and excessive heat
December 22, 2013 to April 17, 2014	Freeze	Yes	Production

Source: USDA, 2014
**Disaster event occurred within the county.*
M Presidential Major Disaster Declaration
N Administrative Physical Loss Notification
S Secretarial National Disaster Determination
USDA United States Department of Agriculture

Probability of Future Events

Several extreme temperature events occur each year throughout Putnam County. It is estimated that the County will continue to experience extreme temperatures annually that may induce secondary hazards such potential snow, hail, ice or wind storms, thunderstorms, drought, human health impacts, utility failure and transportation accidents as well as many other anticipated impacts.

Putnam County will continue to experience direct and indirect impacts of extreme temperatures approximately every five years. Table 5.4.2-9 summarizes the occurrences of extreme temperature events and their annual occurrence (on average).

Table 5.4.2-9. Occurrences of Extreme Temperature Events in Putnam County, 1950 - 2014

Event Type	Total Number of Occurrences	Annual Number of Events (average)
Extreme Heat	8	0.13
Extreme Cold	5	0.08
Total:	13	0.20

Source: NOAA-NCDC, 2014

Based on historical records and input from the Planning Committee, the probability of occurrence for extreme temperatures in Putnam County is considered "frequent" (hazard event that is likely to occur within 25 years) (see Section 5.3, Tables 5.3-4 and 5.3-6).

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 sea level rise 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 (New York State Energy Research and Development Authority [NYSERDA], 2011).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Putnam County is part of Region 5, East Hudson and Mohawk River Valleys. Some of the issues in this region, affected by climate change, include: more frequent heat waves and above 90°F days, more heat-related deaths, increased frequency of heavy precipitation and flooding, decline in air quality, etc. (NYSERDA, 2011).

Temperatures in New York State are warming, with an average rate of warming over the past century of 0.25° F per decade. 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. By the end of the century, the greatest warming is projected to be in the northern section of the State (NYSERDA, 2014).

Regional precipitation across New York State is projected to increase by approximately one to eight-percent by the 2020s, three to 12-percent by the 2050s, and four to 15-percent by the 2080s. By the end of the century, the greatest increases in precipitation are projected to be in the northern areas of the State (NYSERDA, 2014).

In Region 5, it is estimated that temperatures will increase by 3.5ºF to 7.1ºF by the 2050s and 4.1ºF to 11.4ºF by the 2080s (baseline of 47.6ºF). Precipitation totals will increase between 2 and 15% by the 2050s and 3 to 17% by the 2080s (baseline of 38.6 inches). Table 5.4.2-10 displays the projected seasonal precipitation change for the East Hudson and Mohawk River Valleys ClimAID Region (NYSERDA, 2011).

Table 5.4.2-10. Projected Seasonal Precipitation Change in Region 5, 2050s (% change)

Winter	Spring	Summer	Fall
+5 to +15	-5 to +10	-5 to +5	-5 to +10

Source: NYSERDA, 2011

5.4.2.2 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For the extreme temperature events, the entire County has been identified as exposed. 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 Putnam County including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact on: (1) life, health and safety of residents, (2) general building stock, (3) critical facilities (4) economy and (5) future growth and development
- Effect of climate change on vulnerability
- Further data collections that will assist understanding of this hazard over time

Overview of Vulnerability

Extreme temperatures generally occur for a short period of time but can cause a range of impacts, particularly to vulnerable populations that may not have access to adequate cooling or heating. This natural hazard can also cause impacts to agriculture (crops and animals), infrastructure (e.g., through pipe bursts associated with freezing, power failure) and the economy.

Data and Methodology

At the time of this Plan, insufficient data is available to model the long-term potential impacts of extreme temperature on Putnam County. Over time, additional data will be collected to allow better analysis for this hazard. Available information and a preliminary assessment are provided below.

Impact on Life, Health and Safety

For the purposes of this HMP, the entire population of Putnam County is exposed to extreme temperature events. Refer to Section 4 for a summary of population statistics for the County.

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 due to their age, health conditions and limited mobility to access shelters; 2) infants and children up to four years of age; 3) individuals who are physically ill (e.g., heart disease or high blood pressure), 4) low-income persons that cannot afford proper heating and cooling; and 5) the general public who may overexert during work or exercise during extreme heat events or experience hypothermia during extreme cold events (CDC, 2006).

Meteorologists can accurately forecast extreme heat event development and the severity of the associated conditions with several days of lead time. These forecasts provide an opportunity for public health and other officials to notify vulnerable populations, implement short-term emergency response actions and focus on surveillance and relief efforts on those at greatest risk. Adhering to extreme temperature warnings can significantly reduce the risk of temperature-related deaths.

Impact on General Building Stock

All of the building stock in the County is exposed to the extreme temperature hazard. Refer to Section 4 which summarizes the building inventory in Putnam County. Extreme heat generally does not impact buildings.

Losses may be associated with the overheating of heating, ventilation, and air conditioning (HVAC) systems. Extreme cold temperature events can damage buildings through freezing/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.

Impact on Critical Facilities

All critical facilities in the County are exposed to the extreme temperature hazard. Impacts to critical facilities are the same as 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", due to increased usage from air conditioners, appliances, etc. Similarly, heavy snowfall and ice storms, associated with extreme cold temperature events, can cause power interruption 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/loss of inventory. Business-owners may be faced with increased financial burdens due to unexpected repairs caused to the building (e.g., pipes bursting), higher than normal utility bills or business interruption due to power failure (i.e., loss of electricity, telecommunications).

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

Future Growth and Development

As discussed in Sections 4 and 9, areas targeted for future growth and development have been identified across Putnam County. Any areas of growth could be potentially impacted by the extreme temperature hazard because the entire County is exposed and potentially vulnerable. Please refer to the specific areas of development indicated in tabular form and/or on the hazard maps included in the jurisdictional annexes in Volume II, Section 9 of this plan.

Effect of Climate Change on Vulnerability

Climate is defined not simply as average temperature and precipitation but also by the type, frequency and intensity of weather events. Both globally and at the local scale, climate change has the potential to alter the prevalence and severity of extremes such as extreme temperature events. While predicting changes of extreme temperature events under a changing climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating future climate change impacts on human health, society and the environment (U.S. Environmental Protection Agency [EPA], 2006).

Additional Data and Next Steps

For future plan updates, the County can track data on extreme temperature events, obtain additional information on past and future events, particularly in terms of any injuries, deaths, shelter needs, pipe freeze, agricultural losses and other impacts. This will help to identify any concerns or trends for which mitigation measures should be developed or refined. In time, quantitative modeling of estimated extreme heat and cold events may be feasible as data is gathered and improved.