Ulster County

Climate Adaptation Planning Municipal Toolkit

Climate Hazards Summary

January 2023

Contents

This project has been funded in part by the Climate Smart Communities Grant Program, Title 15 of the Environmental Protection Fund through the New York State Department of Environmental Conservation. NYSDEC.

This summary was compiled by Resilience Communications & Consulting, LLC

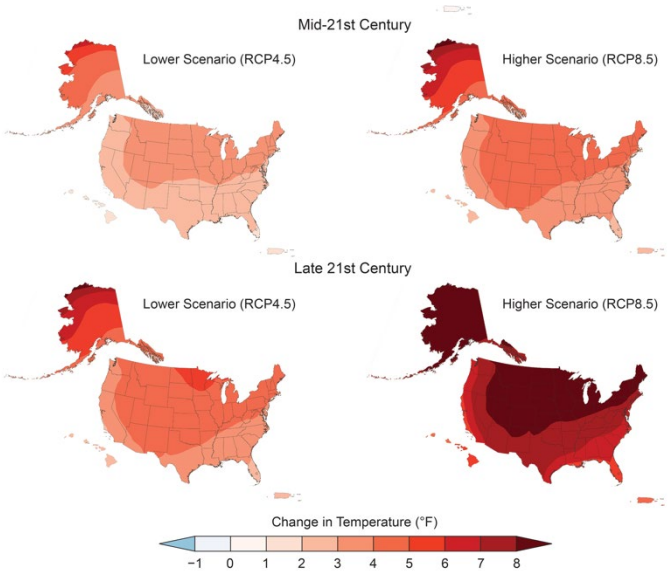
Introduction

This climate summary provides a broad overview of observed and projected climate hazards in Ulster County, NY. It is intended to support municipalities using the Ulster County Climate Adaptation Planning interactive web map and toolkit available online at: https://climate-change-vulnerability-assessment-ulstercounty.hub.arcgis.com/. These resources have been developed to help municipalities conduct climate vulnerability assessments and identify priority adaptation strategies in alignment with the New York State Climate Smart Communities Program actions: PE7 Action: Climate Vulnerability Assessment and PE7 Action: Climate Adaptation Plan.

This summary includes observed trends as well as modeled projections of changes in climate through the end of the century. The projections are based on global greenhouse gas emissions scenarios developed by the climate modeling community. Researchers have developed a set of four "representative concentration pathways" (RCPs), which explore a range of scenarios, from a dramatic reduction in emissions (RCP 2.6) to high levels of emissions (RCP 8.5). This document refers to the intermediate emissions scenario, RCP 4.5, which indicates a stabilization of the Earth's energy balance shortly after 2100. It also references RCP 8.5, which indicates increasing emissions over time, and greater instability in the Earth's climate. These scenarios are intended to present decision-makers with a range of potential outcomes to inform their decisions. Recent findings from scientists at the Woodwell Climate Research Center indicate that the RCP 8.5 scenario is the best match for probable conditions at least through mid-century.[1]

Climate Hazards and Observed/Projected Trends

Projected Change in Temperature in the U.S.[2]



Rising temperatures are contributing to hotter summers, warmer winters, disrupted seasonal patterns, and more frequent severe weather events[2]. Average annual temperatures have risen by almost 2.5°F in New York[3] since the beginning of the 20th century. Weather data collected at the Mohonk Preserve weather station in New Paltz shows that the average temperature has risen approximately 2°F over the past 126 years[4]. Temperatures in the 2000's have been higher than any other historical period[3]. Sixteen of the last 17 years have been the warmest ever recorded by human observation[3]. In 2022, July ranked among the 20 warmest[9], and August was the 5th warmest[10] since record-keeping began in 1895. By the 2080's, annual average temperatures across New York are projected to increase by an additional 4°F under the lower emissions scenario and by more than 6°F under the high emissions scenario[5].

Extreme Heat

Extreme heat days have maximum temperatures at or above 90°F, and heat waves are periods of three or more consecutive days with maximum temperatures of at least 90°F[5]. Extreme heat is particularly dangerous in urban areas, where the heat island effect amplifies high temperatures. Elevated levels of humidity also magnify the effects of hot temperatures[7]. The combination of high relative humidity and hot air temperatures can lead to heat stress for people, animals and infrastructure[8]. The frequency and duration of hot days and heat waves are increasing[2].

- ***Observed:*** The mean number of days with temperatures above 90°F increased from 3.3 days between the 1950's-1980's, to 4.7 days between 1983 -2012[6].
- ***Projected:*** The annual number of hot days in New York State is expected to increase as this century progresses. The average number of extreme heat days per year is projected to triple, at a minimum, to 17.8 – 23.7 in the 2050's, to 26.1 – 63.3 by the end of the century[6].

Milder Winters & Shifting Seasons

Winters in the northeastern U.S. have warmed three times faster than summers, at a rate of more than 1°F per decade[5]. Milder temperatures and earlier spring conditions are replacing the long, cold winters that were typical in the past[2]. The number of days with minimum temperatures below 32°F are decreasing. The freeze-free period across much of the Northeast is expected to lengthen by as much as two weeks by the 2050's under the lower emissions scenario[5]. The decline in cold temperatures is resulting in more precipitation falling as rain or sleet instead of snow[2]. Fewer days with snow cover, earlier snow melt, and less lake ice are anticipated in coming decades[2].

- ***Observed:*** The number of days with temperatures below 32°F have decreased from a mean of 143 days between the 1950's and the 1980's, to a mean of 141 days from 1983 to 2012[6].
- ***Projected***: Cold days (<32°F) are projected to decrease to a mean of 109-117 per year by the 2050's and 82-109 per year by the end of the century[6].

Severe Weather

Severe weather events are projected to increase. In addition to heat and heat waves, other types of severe weather events may include precipitation and flooding, tornadoes and wind, nor'easters, winter storms, and hurricanes.

- ***Observed:*** Several severe weather events have occurred in Ulster County in recent years. In February, 2022 ice and snow associated with winter storm Landon led to widespread power outages. In July, 2022, a State of Emergency was declared when a severe storm brought flooding rains, hail and intense winds to parts of the county, and an EF-1 tornado with 90 mph winds touched down west of Kingston.
- ***Projected***: The Ulster County Multi-Jurisdictional Hazard Mitigation Plan indicates that the probability of future occurrence of severe weather events is high, with the "frequency and intensity of coastal storms and severe weather events…expected to increase in the future due to climate change"[11].

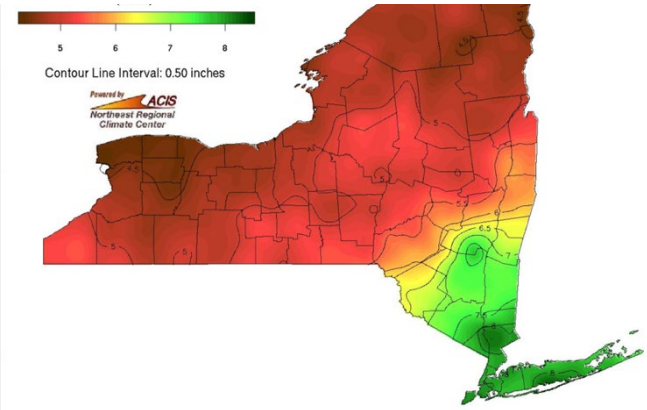
Heavy Precipitation & Flooding

Precipitation: Increases in total annual precipitation are projected to be relatively small, but the frequency, intensity and duration of heavy precipitation events are on the rise. Increases in snowfall intensity are also

anticipated, but the frequency of snowstorms will be reduced as warmer temperatures result in more rain instead of snow[2].

The Northeastern U.S. saw more than a 70% increase in the amount of precipitation falling in very heavy events between 1958 and 2010[12]. Additional increases in very heavy precipitation events are expected in the future – with 40% more during 2070-2099 as compared to 1986-2015[12].

Daily precipitation amounts from the 1% storm in NYS[13]



In Ulster County, the 1-in-100-year storm, which has a 1% chance of occurring each year, has historically produced more than 7" of rain in a 24-hour period[13]. But storms once considered to be 1-in-100-year events are occurring more frequently, and are now likely to occur almost twice as often as in the 1950's[13]. Additionally, the topography of the Catskill Mountains often contributes to higher precipitation totals than in other parts of Ulster County.

- ***Observed:***
  - Between 1970-1999, the amount of precipitation falling in the 1-in-100-year storm at Mohonk Lake was 0.36"/hour (8.64"/day).
  - The amount of precipitation falling in the 1-in-100-year storm on Slide Mountain during the same time period was 0.46"/ hour (11.04"/day).
- ***Projected***:
  - Under the higher emissions scenario, precipitation totals for the 1-in-100-year storm at Mohonk Lake is projected to be 0.41"/hour (9.84"/day) from 2040-2069, and .43"/hour (10.32"/day) from 2070-2099[17].
  - Under the higher emissions scenario, precipitation totals for the 1-in-100-year storm on Slide Mountain are projected to be 0.53"/hour (12.72"/day) from 2040-2069, and 0.56"/hour (13.44"/day) from 2070-2099[17].

Flooding: Heavy precipitation events result in more frequent and significant flooding, with resulting impacts to infrastructure, water quality[14], community residents, and many other systems and assets. Increases in heavy precipitation, severe storms and changing seasonal patterns are leading to increased flood risk, especially in riverine areas and Hudson River coastal and inland tidal areas. Additionally, areas with large amounts of impervious surfaces can contribute to increased stormwater runoff and increased flood risk.

- ***Observed:*** Ulster County has been impacted by heavy precipitation and catastrophic flooding, including from Tropical Storms Irene and Lee in 2011 and Hurricane Ida in 2021, among others.
- ***Projected***: The probability of future flooding is certain. Floods are most likely to occur in the late winter and early spring, when severe or long-duration precipitation events combine with melting snow. Late summer flooding due to thunderstorms and tropical systems are expected to increase[11].

FEMA Flood Insurance Rate Maps (FIRMs) have long been the standard for identifying areas at risk of flooding from the 1-in-100-year (1 % annual chance) and 1-in-500-year (0.2% annual chance) storm events. The FIRMs provide important information for identifying areas at risk of flooding, but they are based on historical information and underestimate current and future risk[13].

A study conducted by the Woodwell Climate Research Center in 2021 on flood risk in the Wallkill River watershed in the Town of New Paltz sought to characterize future flood risk. The study combined the effects of river and stormwater flooding to project the 1-in-100-year flood event of the future[14]. The study concluded that today's 1-in-100-year flood will be nearly four times as likely by the end of the century, becoming a 1-in-27-year flood[14]. The 1-in-500-year flood will be 3.5 times more likely by 2041-2060 and nearly 8 times as likely by the end of the century[14]. In addition to becoming more frequent, flooding will become more severe; the total area inundated by the 1-in-100-year flood on the Wallkill is projected to increase by 12% by mid-century and by 34% by late century[14]. The average water depth in the flood zone will increase by over a foot by late century[14].

Future rainfall and streamflow events in the Wallkill River watershed in the Town of New Paltz as projected by Woodwell Climate Research Center in 2021[14].

Coastal Storm Surge & Sea Level Rise

Coastal Storm Surge: The tidal Hudson is vulnerable to storm surge from hurricanes, tropical storms and nor'easters[11]. Storm surge is caused primarily by a storm's winds pushing water onshore, which can lead to major flooding and erosion, and it can be more significant when occurring at the same times as high tides.

- ***Observed:*** Hudson River coastal and tidal inland areas experienced significant storm surge flooding from Hurricane Sandy in 2012. More recently, on December 23, 2022 storm surge paired with high tides and a new moon cycle resulted in localized coastal flooding, which was documented in some areas via the MyCoast Flood Watch[16] reporting tool.
- ***Projected***: In the Northeast, there has been increases in hurricane activity since the 1970's, and future hurricane rainfall and intensity are expected to increase[2].

Sea Level Rise: In addition to more intense coastal storms, Hudson River coastal and tidal inland areas are also experiencing sea level rise[5]. Due to land subsidence and other factors, rising waters are having a greater impact in the Hudson Valley than in other parts of the world[3]. As sea levels continue to rise, some areas will experience more frequent high tide flooding, and may become permanently inundated[3].

- ***Observed:*** Sea-level along New York's Atlantic coast and in the tidal Hudson has risen more than 12 inches since 1900[5].
- ***Projected***: The NYS Department of Environmental Conservation's (DEC) sea level rise projections for the mid-Hudson region indicate as much as 27 inches of sea-level rise by the 2050's and as much as 71 inches by 2100[15].

Drought

Occasional drought is a normal, recurrent feature of virtually every region in the United States.

- ***Observed:*** The last severe drought in New York occurred in the mid-1960's, and again in the early and mid 1980's[5]. In 2022, a moderate drought gripped parts of the county during the summer months, prompting the City of Kingston to declare a drought emergency that was subsequently elevated to a stage II water emergency.
- ***Projected***: Long-term projections of drought occurrence are not available, but NYS DEC projects that late summer, short term droughts will become more frequent toward the end of the century[5]. Soil moisture is expected to decrease as a result of higher temperatures increasing evaporation rates[5].

Wildfires

Wildfires have been identified as a moderately high hazard in Ulster County[11]. Areas typically considered to be prone to wildfires include large tracts of wild lands containing heavier fuels. According to the Ulster County Open Space Plan, approximately 32% of the county is protected open space, which consists largely of forest lands in the Catskill Park as well as Minnewaska State Park and Mohonk Preserve along the Shawangunk Ridge.

- ***Observed:*** In the past, wildfires have destroyed thousands of acres, especially in the forested areas in the south and west of the county[11]. In 2022, dry conditions contributed to a wildfire that burned 270 acres in Minnewaska State Park.
- ***Projected***: Wildfire events are expected to continue in Ulster County, and may increase if drought conditions become more prevalent in the future[11].

Table 1: Climate Hazards and Projected Trends

CLIMATE HAZARD(S)	***PROJECTED TRENDS***
Extreme Heat	***increasing frequency & duration***
Milder Winters & Shifting Seasons	***increasing***
Severe Weather	***increasing frequency & severity***
Heavy Precipitation & Flooding	***increasing intensity, frequency & severity***
Coastal Storm Surge & Sea Level Rise	***increasing frequency & severity***
Drought	***increasing frequency & severity***
Wildfire	***increasing risk***

References

[1] Schwalm, C.R., Glendon, S., Duffy, P.B. (2020). *RCP 8.5 tracks cumulative CO^2 emissions*. PNAS 117(33).

[2] Fourth National Climate Assessment, Chapter 2 (2018)

[3] NOAA National Centers for Environmental Information NYS Climate Summary, 2022

[4] Mohonk Preserve Weather Data (2022)

[5] NYSDEC Observed and Projected Climate Change in New York State: An Overview (2021)

[6] NOAA Climate Explorer & the Northeast Regional Climate Center Climate Data Grapher

[7] NYSERDA Responding to Climate Change in New York State (ClimAID), Chapter 1 (2011)

[8] Krajick, K. (2017). *Humidity may prove breaking point for some areas as temperatures rise, says study*. Columbia Climate School State of the Planet.

[9] Northeast Regional Climate Center Northeast Overview – July 2022

[10] Northeast Regional Climate Center Northeast Overview – August 2022

[11] Ulster County Multi-Jurisdictional Hazard Mitigation Plan (2017)

[12] Third National Climate Assessment (2014)

[13] Northeast Regional Climate Center ACIS Extreme Precipitation in NY and New England Interactive Web Tool

[14] Woodwell Climate Research Center Current and Future Flood Risk Under Climate Change in New Paltz, New York (2021)

[15] NYS DEC Part 490, Projected Sea-level Rise

[16] NYS Sea Grant MyCoast Flood Watch

[17] Northeast Regional Climate Center Intensity, Duration, Frequency Curves for NYS