WORKING TOWARD CLIMATE RESILIENCE

General climate information prepared for

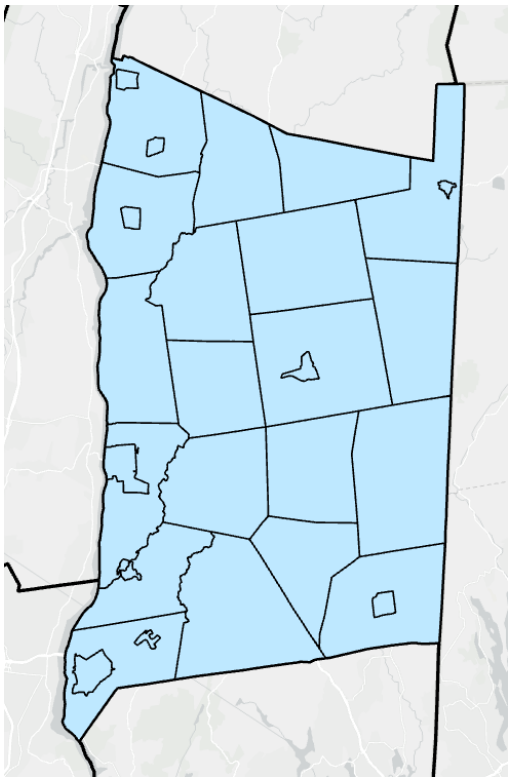
Dutchess County

January 2024

Introduction

The Hudson River Estuary Program prepared this summary of climate planning and decision-making as a part of the Climate Adaptive Planning Institute (CAPI). It identifies historic climate trends and introduces future projections and strategies to address the climate hazards most likely to affect Dutchess County.

MAP OF DUTCHESS COUNTY



This summary provides a starting point for recognizing important climate hazard and risks in the county but is limited to information available to the New York State Department of Environment Conservation (NYS DEC) and its partners at the time of this writing and is not a substitute for on-site survey and assessment. New York's changing climate presents new challenges and opportunities for communities in the state. It is vital for local decision-makers and community members to understand their community's vulnerability to a changing climate and take steps to increase their climate resilience.

Using the latest studies from New York State, this document presents the Dutchess County primary climate hazards and the risks and opportunities they present. A lot can change in a century, so it is never too early to start.

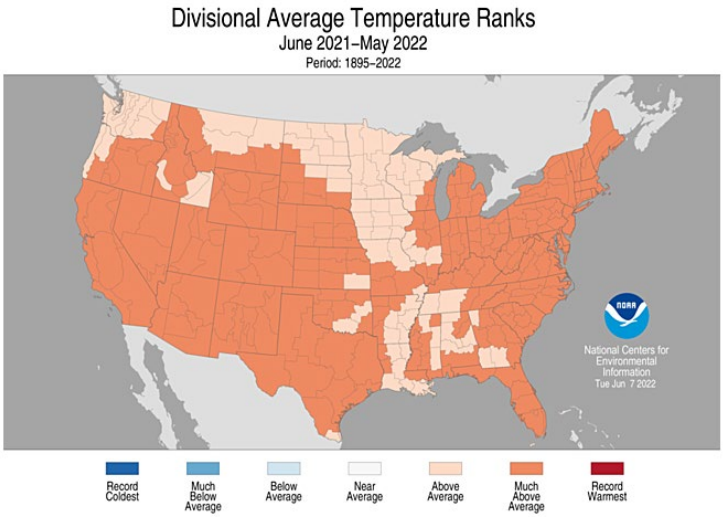
Table of Contents

Climate Hazards in New York State

Three significant climate hazards (trends) are expected to affect New York State residents during the 21st century: *increasing temperatures, rising sea level*, and *changing precipitation patterns*. These trends are leading to three primary climate risks (human impacts): *flooding, heat waves* and *drought*. Communities can plan and implement resilience strategies to reduce their vulnerability and thrive under changing conditions. Risks and resilience opportunities are discussed later in this document.

Increasing Temperatures

Annual average temperatures have been steadily increasing in New York State, posing new challenges to human health, electricity demand, and many of our industries, including tourism, recreation, and agriculture. Since 1970, temperature increases in New York have surpassed national and global averages with our winters being particularly hard hit:



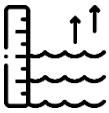
- Global annual average temperature up **1.4°F**
- U.S. annual average temperature up **1.8°F**
- New York annual average temperature up **2.4°F**
- New York winter temperatures up **5°F**

The average annual temperature around Athens is expected to increase approximately four to six degrees by mid- century and as much as 11 degrees by 2100. Overall, Athens can expect warm temperatures by the end of the century to be similar to South Carolina today.

Air Temperature Projections for the South Hudson River Valley

	Baseline 1981 -2010	2030s	2050s	2080s	2100
Annual average air temperature	50.8° F	52.8 – 55.7°F	54 – 58°F	55.6 – 62.7°F	56° – 64.7°F
Increase in annual average		2.0 – 4.9°F	3.2 – 7.2°F	4.8 – 11.9	5.2 – 13.9°F

Like all projections, these climate projections have uncertainty embedded within them. Sources of uncertainty include data and modeling constraints, the random nature of some parts of the climate system, and limited understanding of some physical processes. Levels of uncertainty are characterized using state-of-the-art climate models, multiple scenarios of future greenhouse gas concentrations, and recent peer-reviewed literature. Even so, the projections are not true probabilities, so the specific numbers should not be emphasized, and the potential for error should be acknowledged



Rising Sea Level

Global sea level is rising due to various factors, including thermal expansion from warmer water temperatures and melting of land-based ice. The Hudson River is connected to and influenced by the sea; therefore, it experiences tides and contains saltwater in its lower reaches. This is why the river south of the federal dam at Troy is considered an estuary. It is also the reason why the Hudson River's water level is rising with global sea level.

Since 1900, sea level in the lower Hudson has risen over 13 inches. More concerning, the water is rising faster and faster (from 2000 to 2014 the average rate was 6.8 millimeters per year compared to 4.6 millimeters per year from 1990 to 2014). Projections for additional sea-level rise along the Hudson River range from 1-10 inches by 2020 and 5-30 inches by mid-century. It is possible that riverfront communities like Athens could experience as much as 71 inches of sea-level rise by the end of this century if rapid melting of the Greenland ice sheet continues.

Sea Level Rise Projections

	Baseline 1981 -2010	2030s	2050s	2080s	2100
Albany Sea Level Rise - Inches	-	5" – 12"	11" – 21"	18" – 41"	21" – 60"

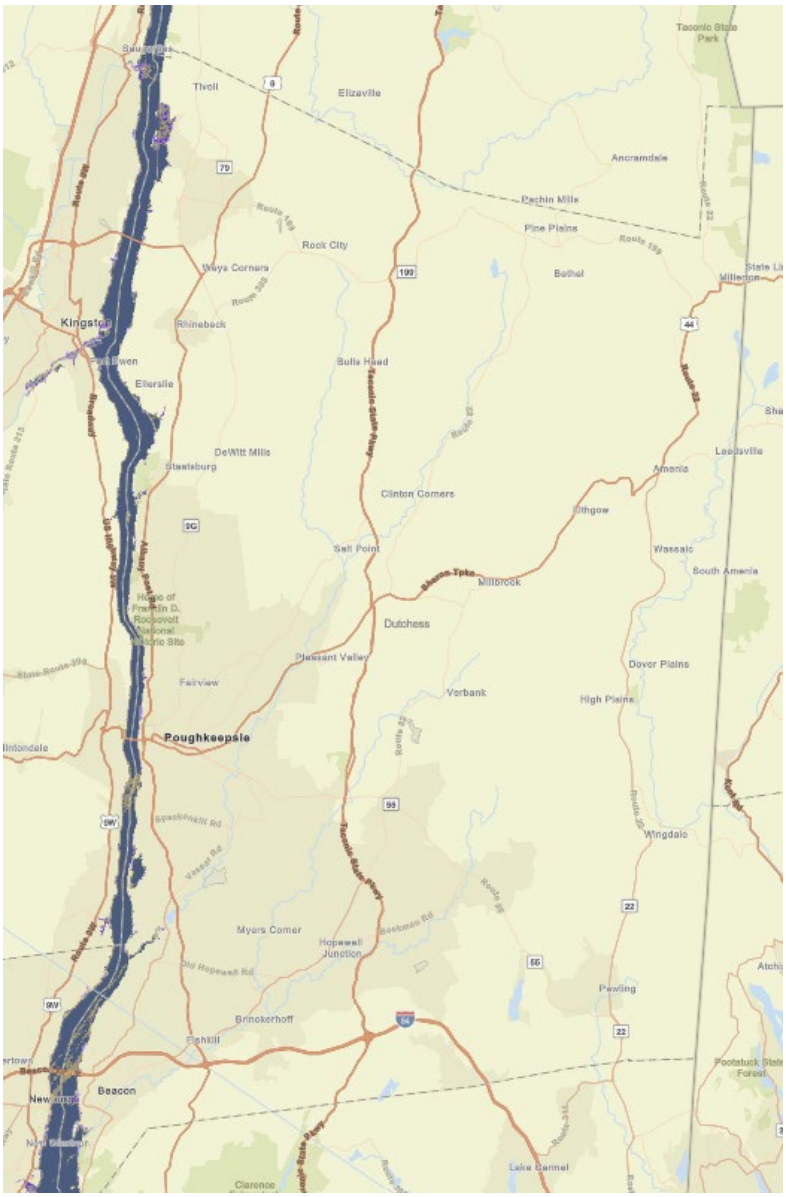
From Climate Impacts Assessment, 2023

Note: Scenarios are three used by the IPCC: SSP2-4.5-medium confidence, SSP5-8.5-medium confidence, and SSP5-8.5-low confidence New York City (The Battery) Sea Level Rise (inches) Like all projections, these climate projections have uncertainty embedded within them. Sources of uncertainty include data and modeling constraints, the random nature of some parts of the climate system, and limited understanding of some physical processes. Levels of uncertainty are characterized using state-of-the-art climate models, multiple scenarios of future greenhouse gas concentrations, and recent peer-reviewed literature. Even so, the projections are not true probabilities, so the specific numbers should not be emphasized, and the potential for error should be acknowledged

	2020s	2050s	2080s	2100
Sea- Level Rise with Rapid Ice Melt	4"-9"	17"-26"	37"-50"	52" – 68"

From NYS 2100 Commission Report

5. Values are the central range (middle 67%) of model-based probabilities; temperature ranges are rounded to the nearest half-degree and precipitation to the nearest 5%. 6. Values are the central range (middle 67%) of model-based probabilities rounded to the nearest inch. The rapid-ice melt scenario is based on acceleration of recent rates of ice melt in the Greenland and West Antarctic Ice sheets and paleoclimate studies.



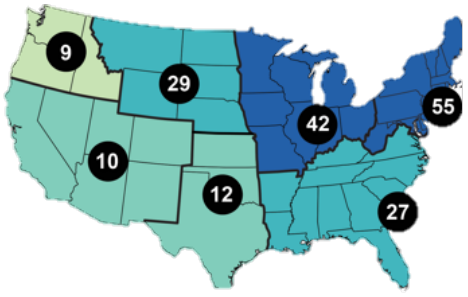
Map of Sea level rise projections for Dutchess county shown for six feet of Sea level rise.

Screenshot taken from [Scenic Hudson's Sea Level rise Mapper](#).

Changing precipitation patterns

Precipitation has become more variable and extreme, whereas total rainfall has changed only marginally. **The amount of rain falling in heavy downpour events increased 55% from 1958 to 2016 in the Northeast**. Projections indicate total annual precipitation could increase as much as 18% by mid- century and 21% by 2100. Overall, New York State models project more dry periods intermixed with heavy rain and decreased snow cover in winter.

Observed Change in Total Annual Precipitation (1958-2016)



(Source: National Climate Assessment, 2016)

Precipitation Projections for the South Hudson River Valley

	Baseline 1981 -2010	2030s	2050s	2080s	2100
Mean Precipitation	45.8 in.	45.8" – 50.4"	46.3" – 51.8"	46.7" – 55.9"	44.9" – 58.6"
% Increase in precipitation		0 – 10%	1-13%	2 – 22%	-2 – 28%

Like all projections, these climate projections have uncertainty embedded within them. Sources of uncertainty include data and modeling constraints, the random nature of some parts of the climate system, and limited understanding of some physical processes. Levels of uncertainty are characterized using state-of-the-art climate models, multiple scenarios of future greenhouse gas concentrations, and recent peer-reviewed literature. Even so, the projections are not true probabilities, so the specific numbers should not be emphasized, and the potential for error should be acknowledged

Climate Risks and Opportunities for Dutchess County

Weather Station Data: Poughkeepsie, NY

Annual Average Temperature form 1901-2020 for observed weather stations

Temperature trend for Southern Hudson River Valley - Poughkeepsie: 0.42 °F/decade

Trend is significant at the 99% significance level

Trends in Annual Precipitation from 1901–2020 for Observed Weather Stations in New York State

Precipitation Trend for Southern Hudson River Valley – Poughkeepsie: 0.32 inches/decade

The following projections are taken from Responding to Climate Change in New York State CimAID Report written in 2011 and updated in 2014. The report delineates climate projections by region. Region 5 (east of the Hudson River and the Mohawk River region), covers Albany, Columbia, Dutchess, Fulton, Herkimer, Madison, Montgomery, Oneida, Putnam, Rensselaer, Saratoga, Schenectady, Washington, and Westchester counties.

PRECIPITATION PROJECTIONS FOR REGION 5

	Baseline 1971-2000	2020s	2050s	2080s	2100
Total annual precipitation	51"	52" - 54.5"	53" - 57"	53.5" - 58.5"	53.5" to 61.5"
% Increase in annual precipitation	-	2 - 7%	4 - 12%	5 - 15%	5 - 21%
# Days with precipitation > 1"	10	14 - 15	14 - 16	15 - 17	*
# Days with precipitation > 2"	1	3 - 4	4	4 - 5	*

HEAT WAVE PROJECTIONS FOR REGION 5

	Baseline 1971-2000	2020s	2050s	2080s	2100
# Days per year above 90˚F	10	26 - 31	39 - 52	44 - 76	*
# Days per year above 95˚F	1	2 - 4	3 - 10	6 - 25	*
# Heat waves per year	1	3 - 4	5 - 7	6 - 9	*
Average # days of each heat wave	4	5	5 - 6	5 - 7	*
# Days per year ≤ 32˚F	155	127 - 136	104 - 119	84 - 109	*

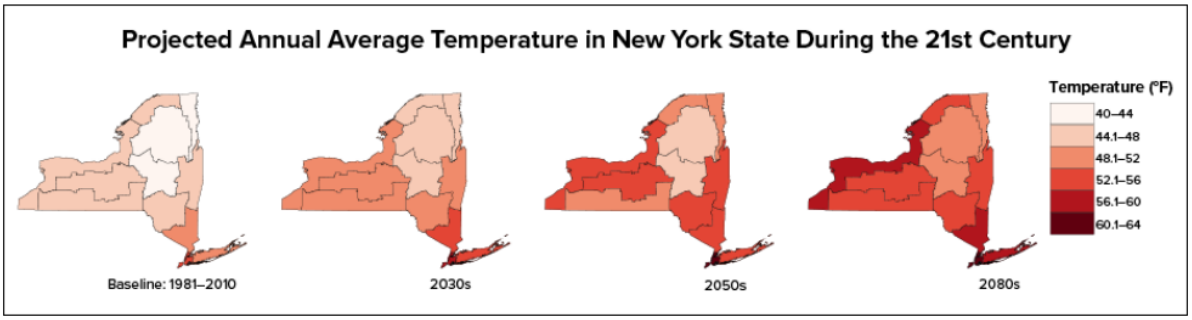
Municipality Accomplishments

MUNICIPALITY	Pleasant Valley (Town)	Poughkeepsie (Town)	Rhinebeck (Town)	Rhinebeck (Village)	Wappingers Falls (Village)	Dutchess County
Registered Climate Smart Community	✓	✓	✓	✓	✓	✓
Certified Climate Smart Community	✓	✓	✓	✓		✓
Completed Climate adaptive Design Studio Phase I						
Completed Climate adaptive Design Studio Phase II						
Flood Resilience Network Member						
Climate Smart Community Actions Completed: Pledge Element 6: Implement Climate-smart land-use						
PE6: Comp Plan with Sustainability Elements						
PE6: Natural Resources Inventory	✓	✓				✓
PE6: Zoning for Protection of Natural Areas (CLU)	✓	✓	✓	✓		
Climate Smart Community Actions Completed: Pledge Element 7: Enhance community resilience to climate change						
PE7: Source Water Protection						
PE7: Water Conservation & Reuse						
PE7: Water-smart landscaping						
PE7 Action: Climate Vulnerability Assessment	✓	✓	✓	✓		
PE7: Evaluate Policies for Climate Resilience	✓	✓				
PE7: Climate Adaptation Planning						
PE7: Hazard Mitigation Plan						✓
PE7: Heat Emergency Plan						

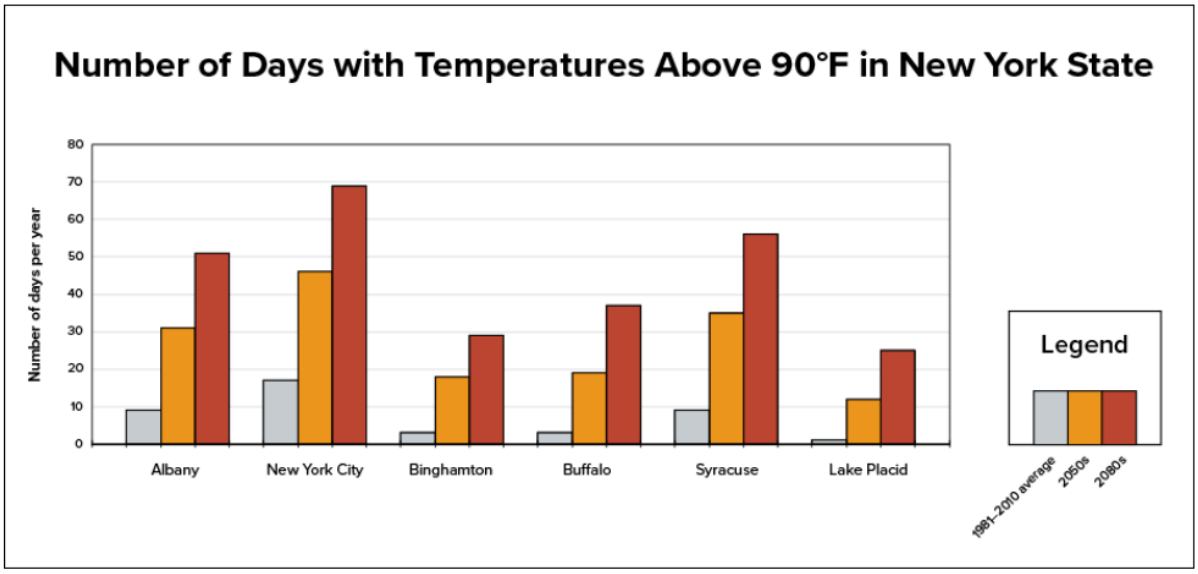
MUNICIPALITY	Pleasant Valley (Town)	Poughkeepsie (Town)	Rhinebeck (Town)	Rhinebeck (Village)	Wappingers Falls (Village)	Dutchess County
PE7: Shade Structures Policy	✓					
PE7: Cooling Centers	✓					
PE7: Conserve Natural Areas	✓					
PE7: Watershed-based Flood Mitigation Plan				✓		
PE7: Design Flood Elevation & Flood Maps						
PE7: Culverts and Dams			✓			
PE7: Freeboard Policies						
PE7: Green Infrastructure						
PE7: Riparian Buffers				✓		
PE7: Strategic Relocation						
PE7: Nature-based Shorelines						
PE7: National Flood Insurance Program Community Rating System						
PE7: Watershed Plan for Water Quality						
Climate Smart Community Actions Completed: Pledge Element 9: Inform and inspire the public						
PE9: Climate Change Education & Engagement	✓	✓		✓		

Alternative Graphics for Climate Summaries

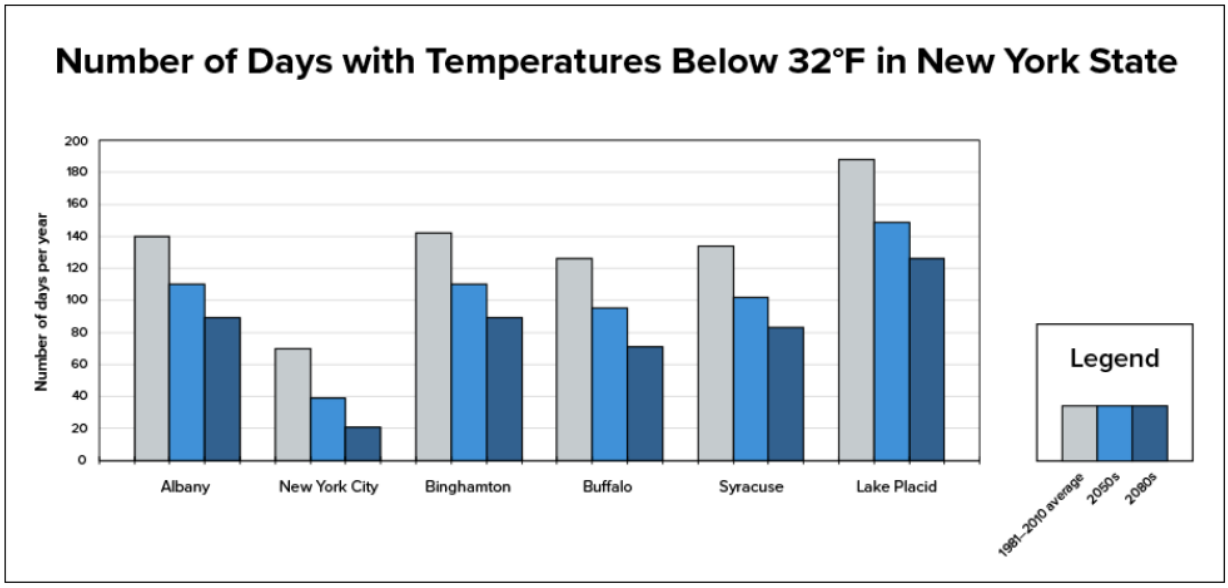
Graphics from [Climate Impacts Assessment](), 2023



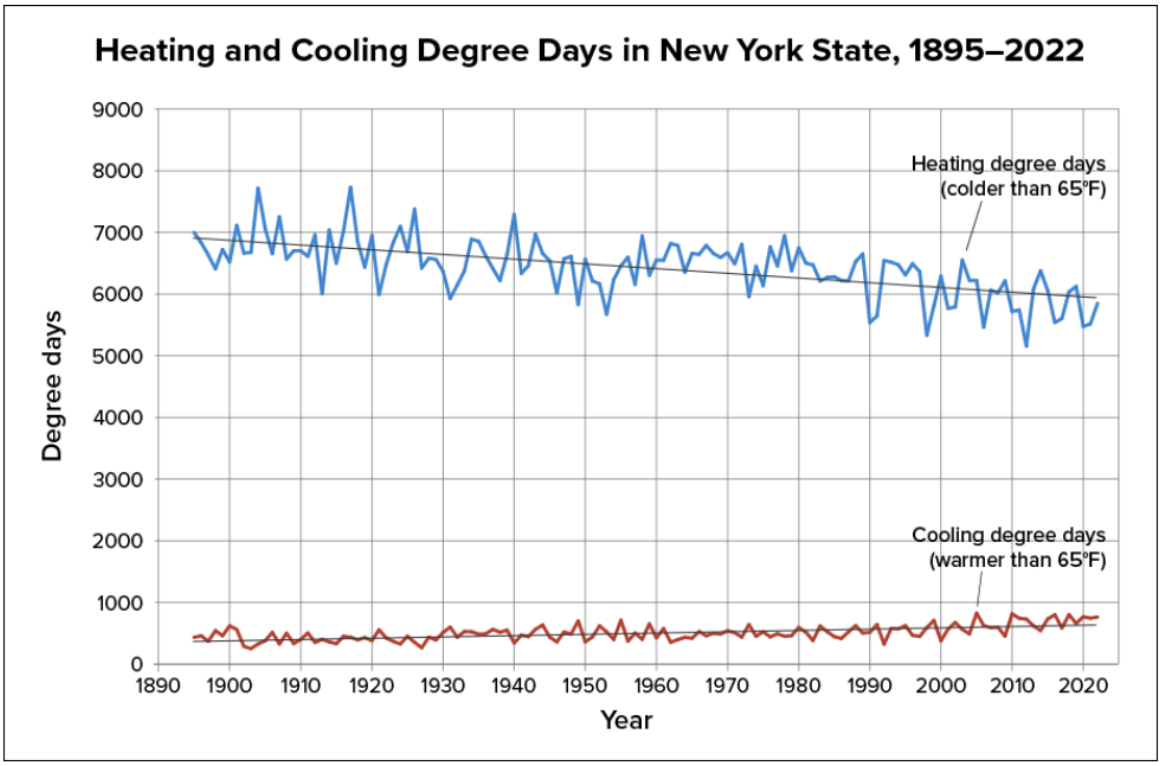
Projected changes to annual average temperatures over the course of the century. Refer to Chapter 2, New York State's Changing Climate, to learn more about this figure. Source: Projections developed for this assessment..



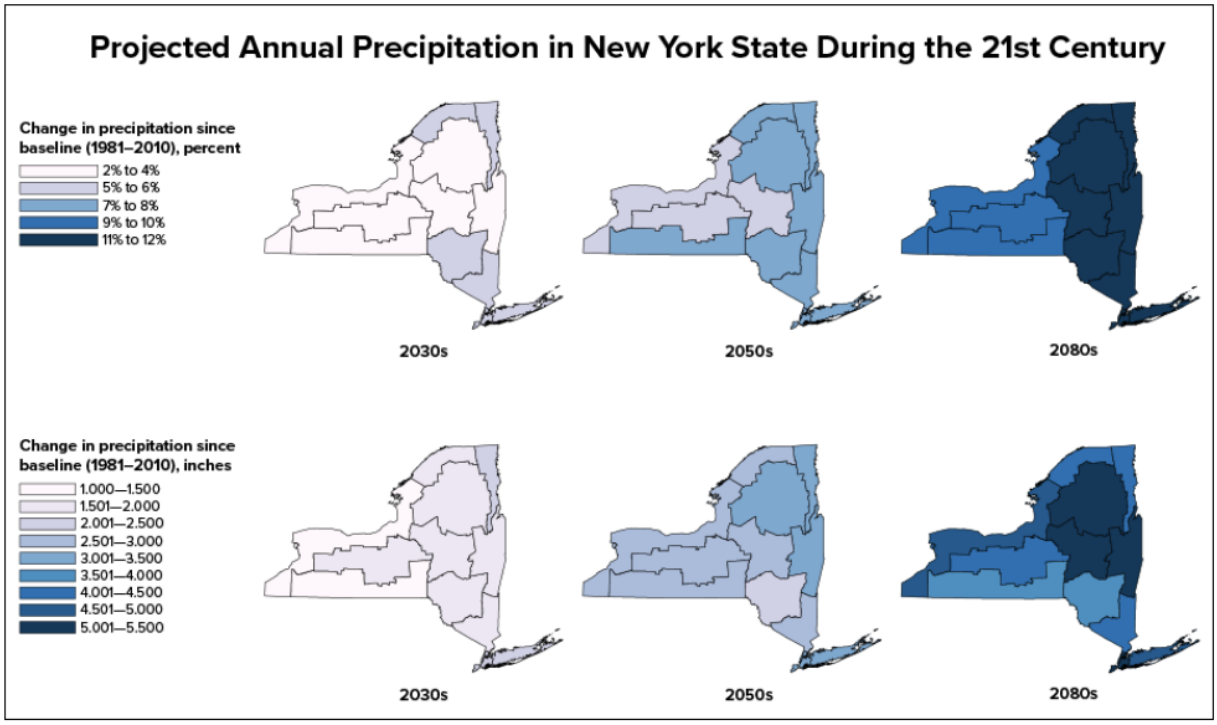
Projected changes to the number of days per year with temperatures above 90°F at six locations across the state. Source: Projections developed for this assessment.



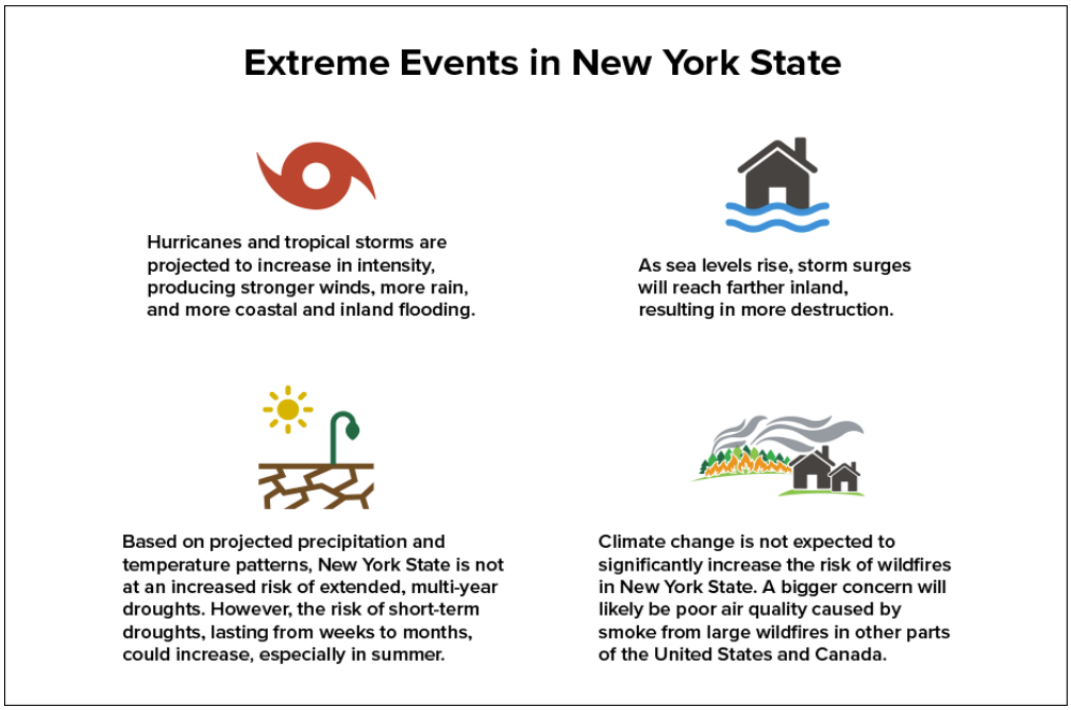
Projected changes to the number of days per year with temperatures below freezing for six locations across the state. Source: Projections developed for this assessment.



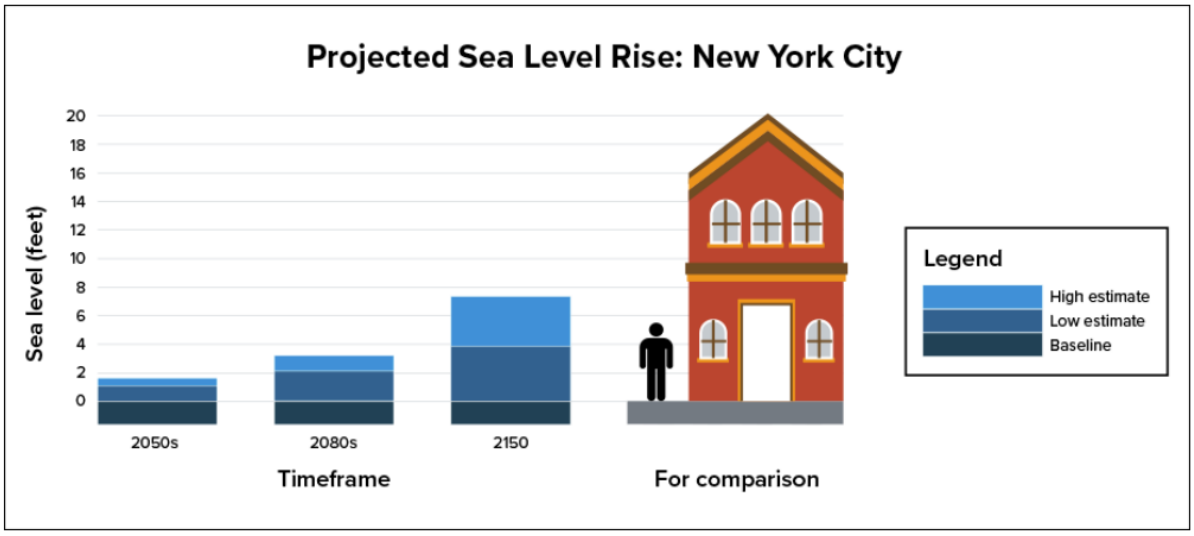
Historical changes to heating and cooling degree days. These trends are projected to continue in the future. Refer to Chapter 2, New York State's Changing Climate, to learn more about this figure. Source: Projections developed for this assessment.



Projected changes to precipitation in New York State over the course of the century. Refer to Chapter 2, New York State's Changing Climate, to learn more about this figure. Source: Projections developed for this assessment.



Projected changes to extreme events in New York State. Source: Projections developed for this assessment.



Projected sea level rise for New York City. The figure includes three timeframes (2050s, 2080s, and 2150) and a high and low sea level rise estimate for each. A person (5 feet, 6 inches) and two-story house (20 feet) are provided for comparison. This graphic shows a visual representation of the average projected sea level rise; observable changes in water level will vary throughout the city depending on distance from the shoreline, elevation above sea level, and many other factors. Source: Projections developed for this assessment.

Alternative Hazard to potentially include

Invasive Species Data

Invasive Species (Screenshots taken from CCE Dutchess Website)

Top Ten invasive species with an assessment of "Very High" Invasive Nature based on DEC 4-Tier Assessment.

Number	Common Name	Scientific Name
1	Eurasian Watermilfoil	Myriophyllum spicatum
2	Japanese Knotweed	Fallopia japonica
3	Autumn Olive	Elaeagnus umbellata
4	Broadleaf Water-Milfoil	Myriophyllum heterophyllum
5	Common Reed Grass	Phragmites australis
6	Water Thyme	Hydrilla verticillata
7	Mile-A-Minute (MaM)	Persicaria perfoliata
8	Purple Loosestrife (PL)	Lythrum salicaria
9	Japanese Barberry (JB)	Berberis thunbergii
10	Black Swallow-wort (BSW)	Cynanchum louiseae

There are some additional highly destructive invasive species that are either in Dutchess County or within striking range of Dutchess County that should be mentioned and monitored:

Significant Invasive Species either in, or within close proximity to Dutchess County, NY.

Number	Common Name	Scientific Name
1	Brown Marmorated Stink Bug (BMSB)	Halyomorpha halys
2	Emerald Ash Borer (EAB)	Agrilus planipennis
3	Hemlock Woolly Adelgid (HWA)	Adelges tsugae
4	Japanese Stilt Grass (JSG)	Microstegium vimineum
5	Viburnum Leaf Beetle (VLB)	Pyrrhalta viburni

The table below provides a list of other invasive species common to Dutchess County that have increased in population over the past ten years:

Species Common to Dutchess County that have Increased in Population.

Number	Common Name	Scientific Name
1	Garlic MustardInvasive	Alliaria petiolata
2	Porcelain Berry	Ampelopsis brevipedunculata
3	Oriental Bittersweet	Celastrus orbiculatus
4	Mugwort	Artemisia vulgaris
5	Tree of Heaven	Ailanthus altissima
6	Chinese Water Chestnut	Eleocharis dulcis
7	Zebra Mussels	Dreissena polymorpha
8	Japanese Beetle	Popillia japonica
9	Multi-Colored Asian Lady Beetle	Harmonia axyridis

For More Information on Invasive Species contact the CCEDC Commerical Horticulture Program:

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