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New Jersey Climate Change Resource Center

State of the Climate

New Jersey 2025

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Foreword

The *State of the Climate: New Jersey* report annually summarizes updated scientific information on climate trends and projections that can be used by state and local decision-makers, researchers, hazard planning and climate resilience professionals, and residents. The *State of the Climate: New Jersey* report is developed by Rutgers University through its hosting of the New Jersey Climate Change Resource Center. The report provides end users with the information they need to monitor changing climate conditions to prepare for future impacts. For prior reports in this series visit https://njclimateresourcecenter.rutgers.edu/resources/state-of-the-climate-new-jersey/.

This report is organized in the following sections:

1. A Summary of New Jersey climate trends from 1895 to 2025 and climate projections through 2100. (pg. 4)
2. A brief discussion of global climate trends that affect conditions in New Jersey. (pg. 7)
3. A synopsis of outstanding 2025 weather events in New Jersey. (pg. 11)
4. An in-depth analysis of historical climate data and future projections for New Jersey, with a focus on temperature, sea-level rise, precipitation, and extreme events, such as tropical storms. (pg. 14)
5. A discussion of the mechanics and effects of the June 2025 heat wave, which affected much of the eastern U.S., and how these types of extreme heat events may be exacerbated with continued climate change. (pg. 26)
6. A summary of different indicators of climate change in New Jersey and the surrounding region that provide community-scale effects of the abstract changes in climate for the region and how these relate to economic and health impacts. (pg. 33)

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Contents

New Jersey 2025 Summary of Climate Trends

- The year 2025 was the third warmest on record globally (1880–2025) and the 21st warmest year on record in New Jersey (1895–2025). This year represented a continuation of the long-term climate change trend in global temperatures that drives regional effects and hazards in New Jersey. As such, this report focuses on changes in temperature, sea-level rise, precipitation, and extreme events in New Jersey, describing both historical trends and projected future hazards. Projections of future climate trends are derived from a range of emissions scenarios. These scenarios represent different assumptions about future global greenhouse gas production based on varying levels of human activity and policy decisions.

- **Temperature** – Like most locations globally, New Jersey has seen increases in annual and seasonal temperatures in recent decades. New Jersey's annual temperatures have risen by approximately 4 °F since 1900, roughly twice the global (over land and ocean surface) average and about 1.1 times the global over-land average (the average temperature of Earth's landmass, excluding oceans). This warming trend is expected to continue with further climate change, leading to increased heat-stress-related health conditions, especially among vulnerable populations; more widespread damage to built infrastructure such as roads and electrical wires; and exacerbation of conditions contributing to wildfires. By 2100, the annual average temperature in New Jersey is projected to be 3.7–6.2 °F above the 1991–2020 normal with a moderate greenhouse gas emissions scenario or 5.8–8.6 °F above normal with a high greenhouse gas emissions scenario.

- **Sea-level rise** – Sea level has been perennially increasing along the New Jersey coastline at about 0.17 inches/yr (~19.1 inches since the early 1900s) due to global sea-level rise, land subsidence, and other processes that affect the local sea level such as changes in ocean circulation. Heightened sea levels exacerbate flooding during coastal storms and very high tides and can salinate freshwater ecosystems and resources. Future sea level projections for New Jersey have been reported by a Rutgers-led Science and Technical Advisory Panel (STAP) in 2016 and two subsequent reports in 2019 and 2025 that were engaged at the request of the New Jersey Department of Environmental Protection. Future sea level projections from the most recent 2025 STAP report found that, relative to the 2005–2014 mean sea level and not considering rapid ice-sheet loss processes, sea level by 2100 in New Jersey will likely rise 2.2–3.8 ft with 2.6 °C of global warming (intermediate greenhouse gas emissions scenario) and 2.6–4.3 ft with 3.8 °C of global warming (high greenhouse gas emissions scenario). However, the report also provides projections incorporating potential rapid ice-sheet loss processes for stakeholders or projects with lower risk tolerance. The likely upper end of rise for these are 4.5 ft with 2.6 °C of global warming and 5.2 ft with 3.8 °C of global warming.

- **Precipitation** – The total annual rainfall within the state has increased by ~7% since the early 1900s, with the most intense events generating more rainfall compared to historical episodes. Future conditions project an increase in total annual rainfall of about 3–13% by the end of the century using the moderate greenhouse gas emissions scenario, and extreme 24-hour rainfall is projected to increase about 5–15%. In addition to contributing to increases in rainfall, rising temperatures also increase water demand and evaporation, increasing the likelihood of dry soil and drought conditions.

Table 1. Summary of Historic and Projected Trends in New Jersey Climate

	Temperature	Sea-Level Rise	Precipitation	Extreme Events
Historic Trends	New Jersey's annual temperatures have risen by approximately 4 °F since 1900.	Sea level has increased along the New Jersey coastline at 0.17 inches/yr (~19.1 inches since the early 1900s).	Total annual rainfall within New Jersey has increased by ~7% since the early 1900s.	New Jersey and the eastern U.S. experienced an intense heatwave in June 2025 that caused numerous heat-related hospitalizations and damage to infrastructure.
Future Projections	With moderate greenhouse gas emissions, New Jersey's annual temperatures are projected to increase 3.7–6.2 °F by 2100 relative to the 1991–2020 average.	By 2100, sea-level in New Jersey will likely rise 2.2–4.5 ft with 2.6 °C of global warming and 2.6–5.2 ft with 3.8 °C of global warming.	With moderate greenhouse gas emissions, annual rainfall is expected to increase by 3–13% by 2100 and extreme 24-hour rainfall is projected to increase by 5–15%.	With a warming climate, it is likely that New Jersey will experience more intense and longer lasting heat waves associated with a longer heat wave season.

- **Extreme events: Focus on the June 2025 Heat Wave** – In June 2025, New Jersey and much of the eastern U.S. was subject to an extreme heat wave from June 22–26. Across New Jersey, daily high temperatures and heat indices exceeded 100 °F at many locations with elevated overnight temperatures. The extreme temperatures created dangerous conditions, resulting in hospitalizations from heat stress, heat exhaustion, and dehydration. Infrastructure was similarly affected, with roads and railways being damaged and heavy stress on the state electrical grids as residents relied on increased air conditioning usage to cope with the high temperatures. The 2025 heat wave can serve as an example of future conditions as the heat wave season continues to lengthen and intensify, highlighting ongoing and worsening challenges facing New Jersey.

A note on using climate projections for risk management: This report utilizes projections from global climate models and studies to elucidate overall trends in warming, precipitation, and sea-level rise. However, these models may underrepresent the potential for extreme events and cascading impacts arising from abrupt shifts in the climate system or heightened variability in extreme weather. For long-term risk and resilience planning, stakeholders may want to consider high-impact, low-probability events that could lead to effects beyond what are described within the average change context of this report.

Global Climate

The increased atmospheric concentration of greenhouse gases (e.g., carbon dioxide [CO_2], methane [CH_4]) has caused an increase in global temperatures and changes in the global climate system. [1] In 2024, CO_2 and CH_4 concentrations accounted for approximately 66% and 16% of the observed global heating, respectively. [2] Most of the remaining 18% of the observed warming can be attributed to nitrous oxide (N_2O, 6.4%) and long-lived compounds like chlorofluorocarbons (CFCs) and other halocarbons (8.4% and 3.2%, respectively). [2] The growth rate of atmospheric CO_2 concentration has accelerated from roughly 1.6 parts per million per year (ppm/yr) in the 1980s to over 2.6 ppm/yr over the decade of 2015–2024. The current atmospheric concentration of CO_2 is above 425 ppm (Figure 1), the highest it has been in at least 800,000 years. [3] The growth rate of atmospheric CH_4 concentration has increased from 8.5 parts per billion per year (ppb/yr) over the period of 2015–2019 to 12.3 ppb/yr over 2020–2024. [2] Atmospheric N_2O has increased at a rate of about 1.06 ppb/year over the past decade, and the concentration of CFCs has been declining since the year 2000. [2] Since the Montreal Protocol on Substances that Deplete the Ozone Layer in 1987, production and trade of CFCs has been controlled, leading to a reduction of CFC concentrations in the atmosphere and a decrease in their influence on global heating. [2,4]

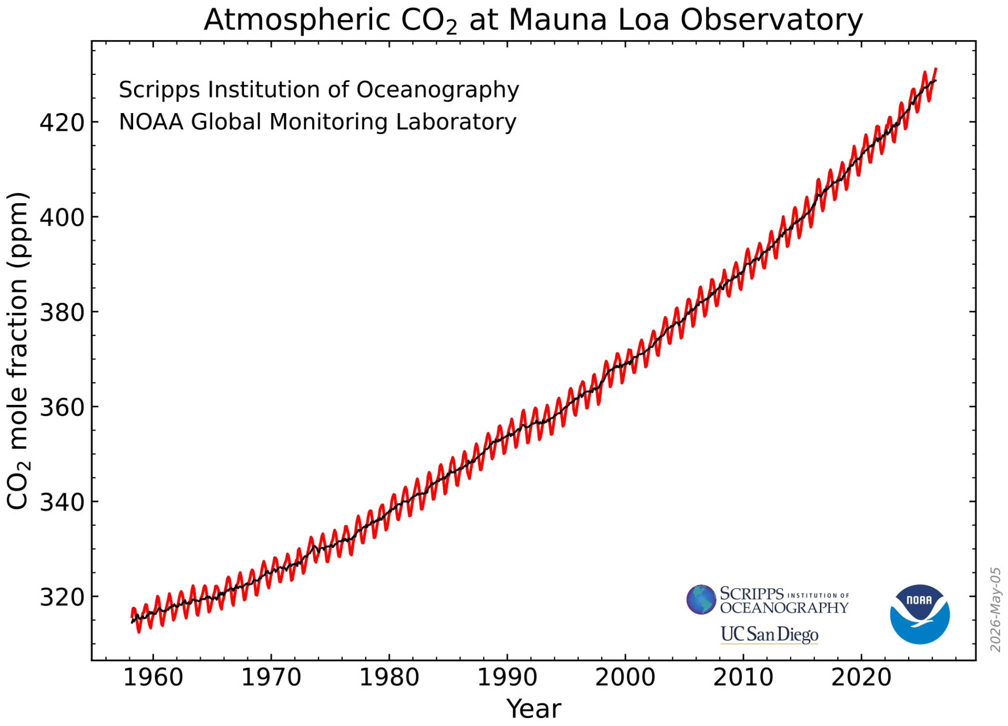


Figure 1: Atmospheric carbon dioxide concentrations in parts per million (ppm) measured at Mauna Loa, Hawaii. Red: monthly values; Black: 12-month running average. [NOAA Earth System Research Laboratory][5]

> The atmospheric concentration of CO_2 is above 425 ppm, the highest in at least 800,000 years. 2025 was the third warmest year on record; 2014–2025 the warmest ten years on record dating back to 1880.

From the late 19th century to today, global temperatures have increased by roughly 2.3 °F [6] and have been rising more rapidly since the 1970s (Figure 2). The year 2025 was the third warmest on record, 2.11 °F above the 20th century average, and the period of 2014–2025 represents the warmest ten years on record dating back to 1880. [7] The average rate of temperature increase has accelerated from roughly 0.14 °F/decade from 1880 to the present to an average rate of 0.37 °F/decade since 1975. [8,9] According to the Intergovernmental Panel on Climate Change (IPCC), it is unequivocal that human activity, mainly the burning of fossil fuels, is the primary cause of increased greenhouse gas concentrations and this observed warming. [1]

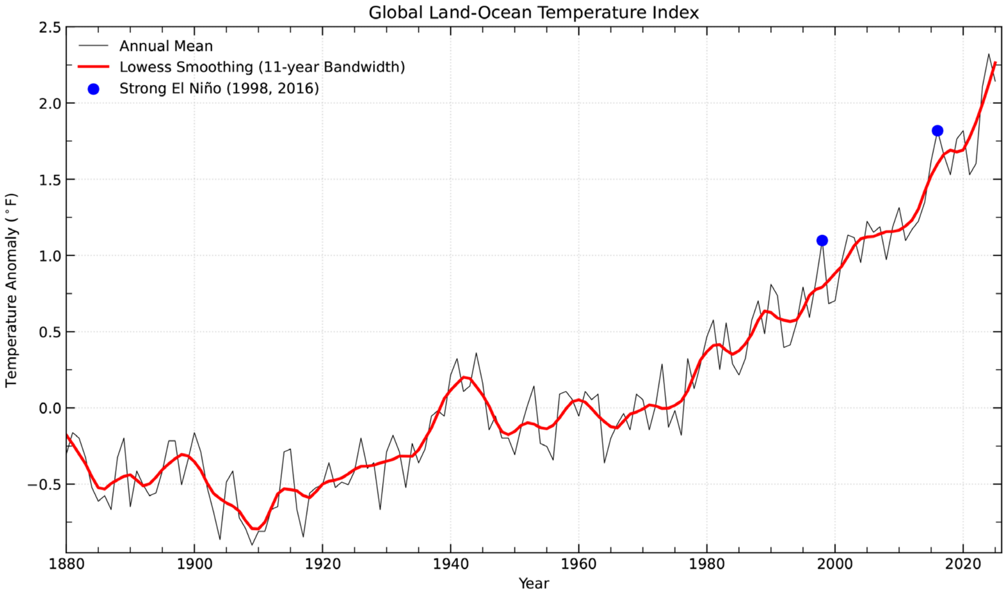


Figure 2. Global land-ocean temperature index anomalies relative to 1951–1980 average temperatures. Blue dots indicate example El Niño events in 1998 and 2016 that significantly increased global temperatures compared to surrounding years. [NASA's Goddard Institute for Space Studies (GISS)] [8,9]

While global temperatures have consistently increased since the 1970s, year-to-year temperature changes are variable. For example, two recent strong El Niño years, 1998 and 2016, exhibited significantly warmer global temperatures relative to surrounding years (Figure 2). The year 2025 did not see El Niño despite being the third warmest year on record. The year began in a La Niña (cold phase) but quickly transitioned to ENSO-neutral by March 2025. This neutral phase continued until October 2025 when the tropical Pacific Ocean transitioned back into La Niña, associated with cooler global temperatures. [10] The result of the neutral and La Niña conditions were dry and drought conditions in the U.S. Southwest while the U.S Northwest and the Rocky Mountains had above-average precipitation and snowpack earlier in the year. [11,12] The La Niña and neutral conditions also led to NOAA predicting a more active Atlantic hurricane season [13] with 13 named storms in 2025 (5 of which were hurricanes), though none made landfall in the U.S. [14]

Additionally, temperature changes vary by location (Figure 3). The Arctic has experienced more than twice the amount of warming than the global average [16] due to sea ice loss and other processes. [17] It should be noted that land areas generally warm more than oceanic regions at the same latitude because the land has a lower heat capacity (it takes less thermal energy to warm the land compared to the ocean), particularly at high northern latitudes. [18] There are multiple factors that have influenced greater warming in the Arctic, known as Arctic amplification, such as warming temperatures melting land and sea ice, diminished snow and ice cover reducing albedo, as well as ocean heat transport and other feedback processes. [19]

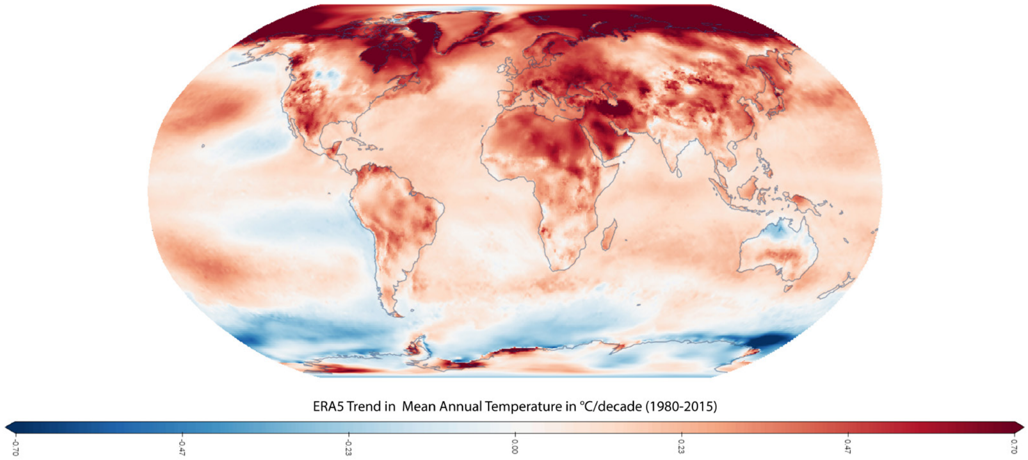


Figure 3. Trend in mean annual temperatures across the globe between 1980 and 2015 from the ERA5 Dataset. Modified from the IPPC WG1 Interactive Atlas.[15]

As global greenhouse gas emissions continue to rise, temperatures are expected to continue increasing. Under the lowest IPCC greenhouse gas emissions scenario from the Sixth Assessment Report (AR6), which would require a drastic reduction of carbon emissions (and net negative emissions – more sequestration of CO_2 than gross greenhouse gas emissions measured in CO_2 equivalent units), temperatures would change by -0.2 °F to +1.2 °F by the end of the 21st century (1.8 °F to 3.2 °F above pre-industrial levels). The high emissions scenario, with heavily increasing greenhouse gas emissions, projects temperatures to rise an additional 3.0 to 6.3 °F by the end of the century (5.0 °F to 8.3 °F above pre-industrial levels). [1]

Note, throughout the remainder of this document, discussion of emission scenarios and analyses will be made in reference to both the recent IPCC AR6 [1] and the prior IPCC AR5. [20] While projected climate change effects related to emission scenarios from the current IPCC AR6 report [1] are available for New Jersey, they have yet to be fully summarized across all climate processes (such as changes to the return periods of extreme rainfall) by authoritative sources. Therefore, AR5 information will be presented where AR6 projections have not yet been fully analyzed.

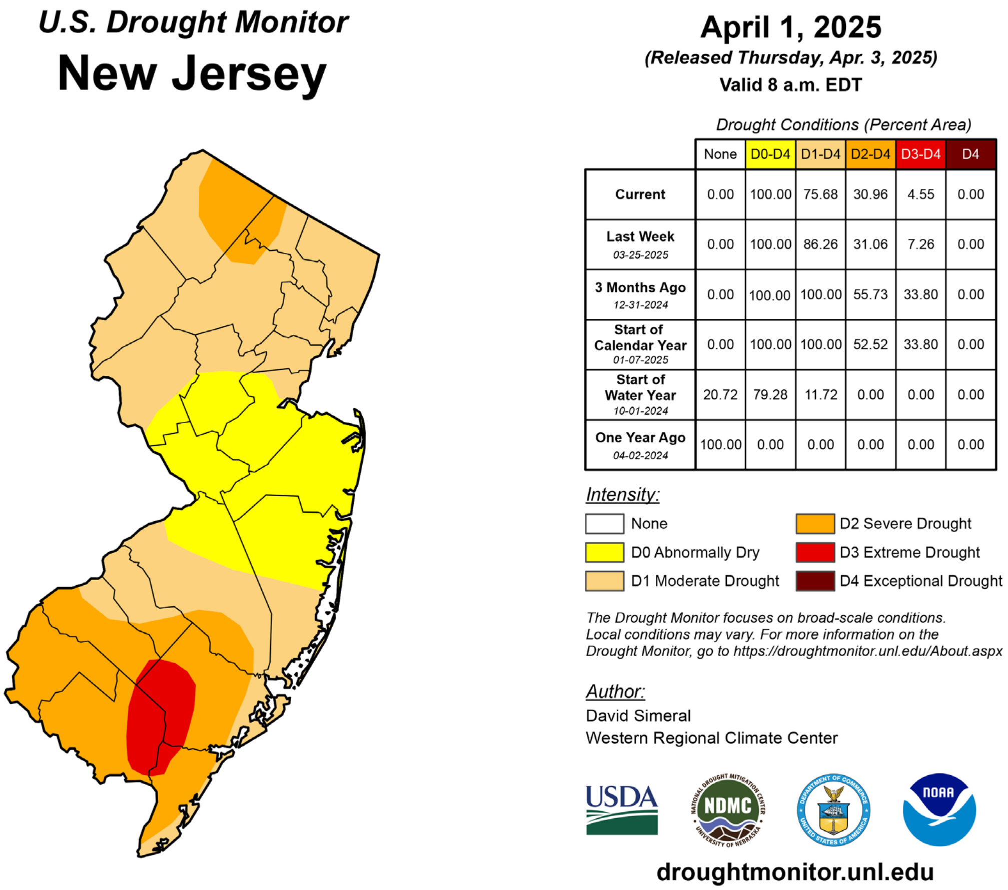
Warming temperatures have raised the global mean sea level by increasing ocean temperatures and melting glaciers and ice sheets. As the ocean warms, it expands, increasing volume and subsequently mean sea level. Simultaneously, melting of terrestrial glaciers and ice sheets contributes additional freshwater that increases sea level. Since 1979, Antarctic Ice Sheet melt is estimated to have contributed 0.6 inches to global sea-level rise [21] and the meltwater from the Greenland Ice Sheet has caused approximately 0.5 inches of sea-level rise since 1972. [22] Global sea level has risen 8–9 inches since 1880 [23] and ~4.6 inches since the start of the satellite measurement era in 1993 with a rate of 1.4 inches/decade over the period of 1993 to 2024. [24,25] AR6 projections indicate a global increase of 0.3–0.5 m (1.0–1.6 feet) by 2100 relative to 2005 with very low greenhouse gas emissions and 0.5–0.9 m (1.6–3.0 feet) with high greenhouse gas emissions. [1]

New Jersey 2025 Weather Summary

The Office of the New Jersey State Climatologist (njclimate.org) serves as New Jersey's primary resource for statewide weather and climate data. Unless otherwise indicated, all observed data presented in the remainder of this report are from the Office of the New Jersey State Climatologist. New Jersey climate data are also archived at NOAA's National Centers for Environmental Information (ncei.noaa.gov). While the purpose of this report is to summarize New Jersey climate change, this section provides a summary of New Jersey weather in 2025. Weather refers to the short-term variations in the state of the atmosphere that result in processes like storms or extreme heat that manifest on a sub-annual time scale. Climate refers to the prevailing weather conditions in a location, including means and extremes, such as average precipitation or temperature, over multiple decades. The time scales between a year and decades can be characterized as either weather or climate, depending on the discussion context. For example, a multiyear drought can be discussed as a singular weather event or as an example of multi-year climate variability.

2025 in New Jersey was characterized by dry conditions starting in May 2024, with the year being the 16th driest on record since 1895 and the driest since 2001. Annual precipitation was about 8.80 inches below average. Throughout the year, much of New Jersey was in stages of drought warning or drought watch. NJ DEP issued a statewide drought warning in November 2024 [26] that continued until June 2025,[27] with a statewide drought watch being issued in October 2025 [28] and a return to statewide drought warning in December 2025, continuing into 2026. [29] For example, as of April 1, 2025, the entire state was categorized as "abnormally dry" or in drought by the U.S. Drought Monitor, with 75% of the state in moderate to extreme drought conditions (Figure 4, next page). In addition to drought conditions, 2025 was moderately warmer than average, with an average annual temperature of 53.7 °F, about 1.8 °F above average, being the 21st warmest year on record since 1895 and the least warm since 2014. The spring of 2025 (March–May) was the 6th warmest on record since 1895, with seven months throughout the year presenting warmer-than-average temperatures. June presented periods of high heat and an extreme heatwave spanning from June 22nd to 25th, [30] as discussed in section 5, with many locations experiencing temperatures above 100 °F.

Figure 4. Spatial distribution of drought conditions in New Jersey on April 1, 2025. [31]



U.S. Drought Monitor

New Jersey

April 1, 2025

(Released Thursday, Apr. 3, 2025)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	75.68	30.96	4.55	0.00
Last Week *03-25-2025*	0.00	100.00	86.26	31.06	7.26	0.00
3 Months Ago *12-31-2024*	0.00	100.00	100.00	55.73	33.80	0.00
Start of Calendar Year *01-07-2025*	0.00	100.00	100.00	52.52	33.80	0.00
Start of Water Year *10-01-2024*	20.72	79.28	11.72	0.00	0.00	0.00
One Year Ago *04-02-2024*	100.00	0.00	0.00	0.00	0.00	0.00

Intensity:

- ☐ None
- 🟨 D0 Abnormally Dry
- 🟧 D1 Moderate Drought
- 🟧 D2 Severe Drought
- 🟥 D3 Extreme Drought
- 🟫 D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to https://droughtmonitor.unl.edu/About.aspx

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droughtmonitor.unl.edu

Partially fueled by the dry conditions, New Jersey experienced more than 1,300 wildfires that burned more than 27,000 acres. [32] The largest was the Jones Road wildfire that occurred between April 22nd and May 12th primarily in Barnegat Township, Ocean County. The fire burned about 15,300 acres and resulted in evacuations from local communities, though structure damage was minimal. [33–35]

The warmer conditions also extended the statewide growing season, following the trend of recent years, especially in coastal and urban areas. The growing season is typically defined as the period of the last freeze of spring to the first freeze of autumn. Multiple Rutgers New Jersey Weather Network stations (njweather.org) recorded their first freeze of autumn on November 29th, such as at the Atlantic City Marina (Atlantic County), Little Egg Harbor (Ocean), Fortescue (Cumberland), and Lower Alloways Creek (Salem), which was a few weeks later than average. Fortescue's growing season was the longest, ranging from March 5th to November 28th.

Despite warmer and drier conditions, there were some notable winter snow events, especially in southern and coastal communities. Cape May County experienced two snowfall events exceeding 8.0 inches in Wildwood Crest and Cape May on January 6th and February 11th–12th, respectively. On December 13th–14th, a winter system produced 8.5 inches of snowfall in Howell (Monmouth County) and 8.2 inches in Highland Lakes (Sussex County).

2025 saw a number of strong and damaging storm effects, with July in particular producing a high number of weather related fatalities due to strong straight-line winds in Union and Somerset counties that felled trees, [36] heavy rainfall in Union and Somerset counties on July 14 leading to flash flooding, [37] and two lightning fatalities in Sussex and Ocean counties on July 8th and 16th, respectively. [38] Coastal storms also affected New Jersey, notably coastal flooding from Hurricane Erin on August 20th–23rd and a stalled nor'easter over October 12th–14th. While Erin never approached New Jersey, it created high surf from large swells generated more than 200 miles offshore. These waves caused flooding and beach erosion, especially on the 21st, with water levels in Cape May Harbor at about 8.1 feet [39] and significant erosion reported at Strathmere, Avalon, Ocean City, and North Wildwood in Cape May County. [40] The October nor'easter caused wind gusts over 40 miles per hour and about 4.00 inches of rainfall along the Ocean County coast. The nor'easter generated notable coastal flooding along the back bays of Ocean, Atlantic, and Cape May counties. [41,42] Moderate to major erosion occurred at a number of locations including Ocean City, Strathmere, North Wildwood, Avalon, and Long Beach Island.

Finally, 2025 was a uniquely windy year for New Jersey, with the State Climatologist's Office noting that wind gusts of over 40 miles per hour were recorded on 99 different days throughout the year. As an example, February 16th saw 39 weather stations across the state recording wind gusts of more than 40 miles per hour, with a maximum of 68 miles per hour.

New Jersey Climate

Temperature

Average annual temperatures in New Jersey have increased by nearly 4.0 °F since the end of the 1800s (Figure 5). The increase in New Jersey temperatures has been about twice the global land and ocean average and about 1.1 times the global over land average since 1900. [44] Between 1900 and 2025, New Jersey's annual average temperature has increased at a rate of 0.33 ± 0.03 °F/decade. Since 1970, New Jersey average temperatures have increased at a rate of 0.66 °F/decade (Figure 5), the equivalent rate of 6.6 °F/century, indicating that warming has been accelerating in the state. The warmest year on record is 2012 (55.9 °F) and the coldest is 1904 (47.8 °F). Despite relatively large year-to-year variability, recent temperatures have been consistently increasing. Out of the 20 warmest years since 1895, 15 have occurred since 2000 (2025 was the 21st warmest year on record). Furthermore, none of the top ten coldest years occurred after 1940. This increase in warming rate has been linked, in part, to higher offshore sea surface temperatures, [45] though scientific consensus has not yet been reached on this hypothesis.

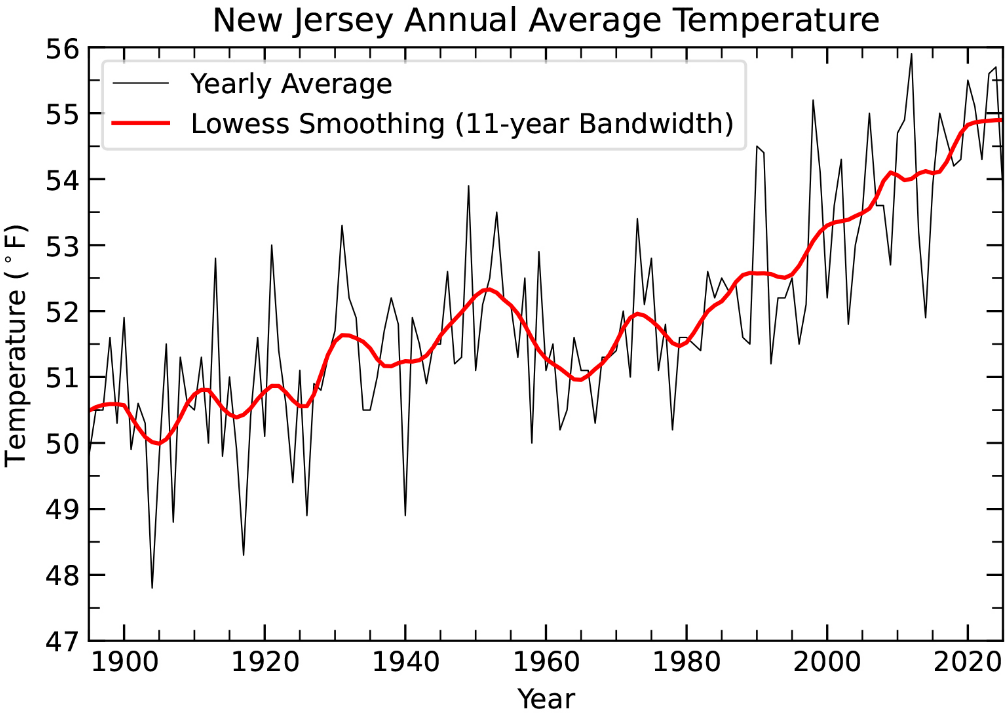


Figure 5. Average annual temperatures in New Jersey (°F). [Office of the New Jersey State Climatologist]

Higher temperatures degrade air quality by increasing pollutants such as ground-level ozone, creating dry conditions conducive for wildfires that generate fine particulate matter, and extending/strengthening the pollen allergy season. [46,47] Poor air quality can lead to higher rates of asthma, allergies, and deaths from respiratory-related illnesses. [47,48] Vector-borne diseases (such as West Nile virus) are also expected to have expanded ranges with increased temperatures (and humidity) as vector species, such as mosquitoes, spread to new locations. [46,49] Higher temperatures will affect the New Jersey agriculture sector by decreasing yields, reducing the viability of some crops (such as blueberries and cranberries), and promoting the expansion of pest and weed species. [50,51] In recent years, New Jersey has experienced elevated early-spring temperatures, causing plants to bloom early (i.e., blueberries, cranberries, and peaches) and harming their production due to damage from spring frost events later in the year after bloom. [52]

As average annual temperatures rise in New Jersey, changes in seasonal temperatures vary substantially and are summarized in Table 2. Average temperatures during each season rose at higher rates over the past 56 years compared to the 126 years since (and including) 1900. Notably, the linear trend in winter temperatures increased by 5.2 °F ± 1.2 °F since 1970, a rate of 9.3 °F ± 2.3 °F/century, consistent with the U.S. northeast regional trend of winter temperatures warming at a higher rate than other seasons. [53,54] Counter to this

Table 2. Average seasonal changes in New Jersey temperatures calculated by linear regression for 1900–2025 and 1970–2025 with temperature increases calculated using the linear fit rate and its standard deviation.

Season	Time Period			
	1900–2025		1970–2025	
	Linear Rate (°F/decade)	Calculated Increase (°F)	Linear Rate (°F /decade)	Calculated Increase (°F)
Winter (December–February)	0.44 ± 0.07	5.5 ± 0.9	0.93 ± 0.22	5.3 ± 1.3
Spring (March–May)	0.29 ± 0.05	3.7 ± 0.6	0.58 ± 0.14	3.3 ± 0.8
Summer (June–August)	0.30 ± 0.03	3.7 ± 0.4	0.58 ± 0.10	3.2 ± 0.5
Fall (September–November)	0.27 ± 0.04	3.4 ± 0.5	0.57 ± 0.11	3.2 ± 0.6

What Are Emissions Scenarios?

How the future drivers of climate change, such as carbon dioxide emissions, will evolve by 2100 is unknown, because they are rooted in global-scale technological, economic, population, and policy changes over the current century. To assist in projecting how the climate may change, scientists use a range of illustrative scenarios to span the range of potential development of greenhouse gas emissions that vary based on socioeconomic assumptions, climate change mitigation strategies, and air pollution controls. [1] Additionally, these scenarios account for potential changes to the carbon cycle, particularly where feedbacks, such as reduced sequestration in soils due to climate change, could further accelerate warming. [60] No single scenario is likely to completely predict future greenhouse gas emissions, but the range provides a series of hypothetical outcomes on how the climate may evolve with enhanced or reduced anthropogenic emissions.

trend, the 2025–2026 winter was the 34th coldest, with the average temperature about 4.4 °F below normal.

Temperatures in New Jersey are expected to continue increasing as global greenhouse gas concentrations rise. Under a moderate emissions scenario (SSP2-4.5, as detailed under the IPCC AR6 [1]), average annual temperatures in New Jersey are projected to increase 3.7–6.2 °F (10th–90th percentile of model projections) by the end of the 21st century relative to the 1991–2020 average. [55–57] Under a high emissions scenario (SSP3-7.0), temperatures are expected to increase 5.8–8.6 °F by 2100. [56,57] These New Jersey-specific projections are consistent with regional projections of increased temperature extremes (e.g., daily maximum temperatures or the number of days above 90 °F or days with a heat index above 100 °F) in the northeast by the middle and end of the century. [58,59] The range of projected temperature increases in New Jersey in response to global greenhouse gas emissions indicates that state-, national-, and global-scale emission policies will greatly influence how New Jersey's climate changes over the next century.

In addition to higher average temperatures, heat stress caused by extreme heat events becomes more concerning with climate change. Heat stress is the leading cause of weather-related deaths in the United States. [61] Higher temperatures combined with high humidity can lead to a higher risk of heat stress because the body's natural cooling from sweating becomes less effective in more humid conditions. [63] In Atlantic City, summer dew point temperatures have risen by more than 3.0 °F since 1980, [63] creating more humid summers and increasing the potential for heat stress. Increased heat stress is expected to cause greater incidences of heat-related illnesses, hospital admissions, and deaths among vulnerable populations. [46,64] Extreme heat can also overburden building cooling systems and cause power outages. [65] High humidity keeps temperatures warmer overnight, limiting people's ability to find reprieve, thereby worsening health outcomes. These effects are amplified in urban sectors where paved surfaces and lack of vegetation contribute to the urban heat island effect that heightens local temperatures compared to surrounding regions, especially at night. [66]

Sea-Level Rise

Between 1911 and December 2025, sea level rose approximately 19.1 inches at Atlantic City (Figure 6), more than double the global average. [23,67] The New Jersey coastline has exhibited a greater sea-level rise rate compared to the global average due in part to land subsidence. In New Jersey, subsidence, or the vertical sinking of the land surface, contributes to relative sea-level rise due to a slow vertical readjustment to the melting of ice sheets from the last ice age, natural sediment compaction, and groundwater withdrawal. [68] The average rate of sea-level rise since the early 20th century has been 0.17 inches/yr. [67,68] However, the yearly mean sea level between 1980 and 2025 increased by 9.9 inches compared to the 19.1 inches of relative sea-level rise in Atlantic City since 1911, a rate of 0.21 inches/yr (Figure 6), indicating that local sea-level rise of late is occurring at a faster rate than earlier in the 20th century. Higher sea levels can permanently inundate parts of the land, consuming property, infrastructure, and homes in low-lying locations near the coast. [69,70] Coastal flooding events become more frequent and larger as storm surges and wave effects are enhanced by a higher base sea level. [70,71] Sea-level rise can also enhance saltwater contamination of freshwater resources used for drinking water and crop irrigation, salinate soils from coastal storm flooding, and threaten freshwater ecosystems by pushing salt water farther upstream in estuaries. [59,70,72,73]

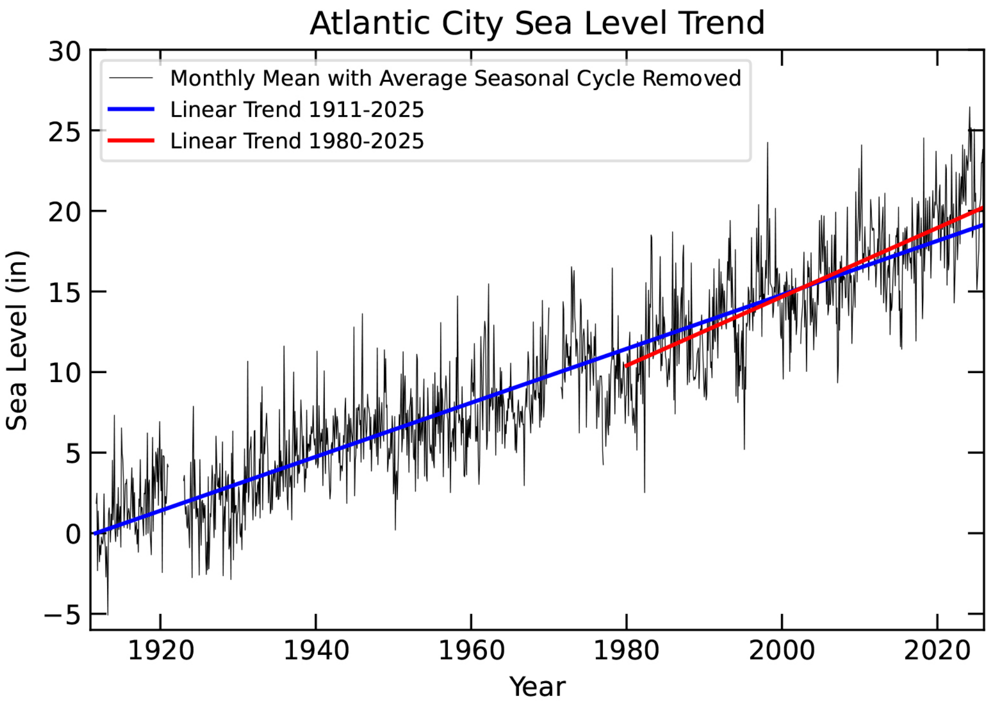


Figure 6. Relative sea level trend (inches) at the Atlantic City Tide Gauge. [67]

Sea-level rise is expected to continue accelerating over the next century. Future sea level projections for New Jersey have been reported by a Rutgers-led Science and Technical Advisory Panel (STAP) in 2016 and two subsequent updated STAP reports were produced in 2019 and 2025 at the request of the New Jersey Department of Environmental Protection. [68,74,75] This report provides two approaches for estimating the likely range of sea-level rise in New Jersey, one excluding rapid-ice sheet loss processes and one including potential rapid ice sheet loss processes. The exclusion of these processes represents a standard, medium-confidence baseline with multiple lines of evidence and high expert agreement on the processes. The inclusion of these processes represents projections with unknown likelihood but are at the forefront of scientific discovery, such as marine ice-cliff instability, that could significantly accelerate sea-level rise. These two approaches were included so that decision-makers can prepare for sea-level rise projections in line with their specific risk tolerance. Please see Kopp et al. (2025) for more detail on these processes and projections. [68] For the purposes of this report, the medium-confidence likely range of sea level change will be followed parenthetically by an extended likely range that incorporates potential rapid ice sheet loss.

Following results from the 2025 report, relative to the 1995–2014 baseline, sea level is projected to increase 0.7–1.3 (1.4) ft by 2040 and 0.9–1.7 (1.9) ft by 2050. [68] During this time frame, projections are largely independent from greenhouse gas emission scenarios, but after 2050, projections deviate depending on emission levels. In a 2.6 °C global warming above preindustrial temperatures scenario (intermediate greenhouse gas emissions), [68] projected sea-level rise at 2100 is expected to be 2.2–3.8 (4.5) ft compared to the average 1995–2014 mean sea level. Under a 3.8 °C warming scenario (high greenhouse gas emissions), sea level is projected to rise 2.6–4.3 (5.2) ft. [68]

As a result of increased sea level, New Jersey's coast has become more subject to minor flooding that includes some small storm effects as well as tidal flooding (also called "sunny day" or "nuisance" flooding). Tidal flooding occurs when high tides cause flooding that is not associated with storm surge or extreme wave effects. Tidal flooding can disrupt roadways, damage buildings, reduce property values, and help overwhelm combined storm and wastewater systems, leading to public health concerns. [70,71,76–78] Tidal flooding can be grouped into a larger class of flooding called minor flooding, which has similarly been increasing on the New Jersey coast. Minor flooding is when water levels reach a height (regardless of its cause) such that the water can cause disruptions like stormwater backups and road closures but is not typically damaging to property or life threatening. [79] Minor flooding thresholds are based on the local tide range and therefore can vary by location; at Atlantic City, this threshold is 1.82 ft above the mean higher high water line. [79] In Atlantic City, the number of days experiencing minor coastal flooding or greater changed from an average of 0.4 flood days per year in the 1950s to more than 12 minor flood days per year between 2016–2025. [80] This range can vary considerably. For example, 2025 experienced only four minor flooding days, while 2024 had the most on record at 22 days. [80] This trend is expected to continue and accelerate with sea-level rise. With the intermediate emissions scenario, [68] the number of minor flooding days in Atlantic City is expected to increase 29–148 (178) days per year by 2050 and 227–359 (364) days per year by 2100. [68] While there is uncertainty in the rate of sea-level rise (there are multiple possible scenarios) as expressed by these ranges, what is clear is that Atlantic City's tidal and minor flooding will increase across all sea-level rise scenarios.

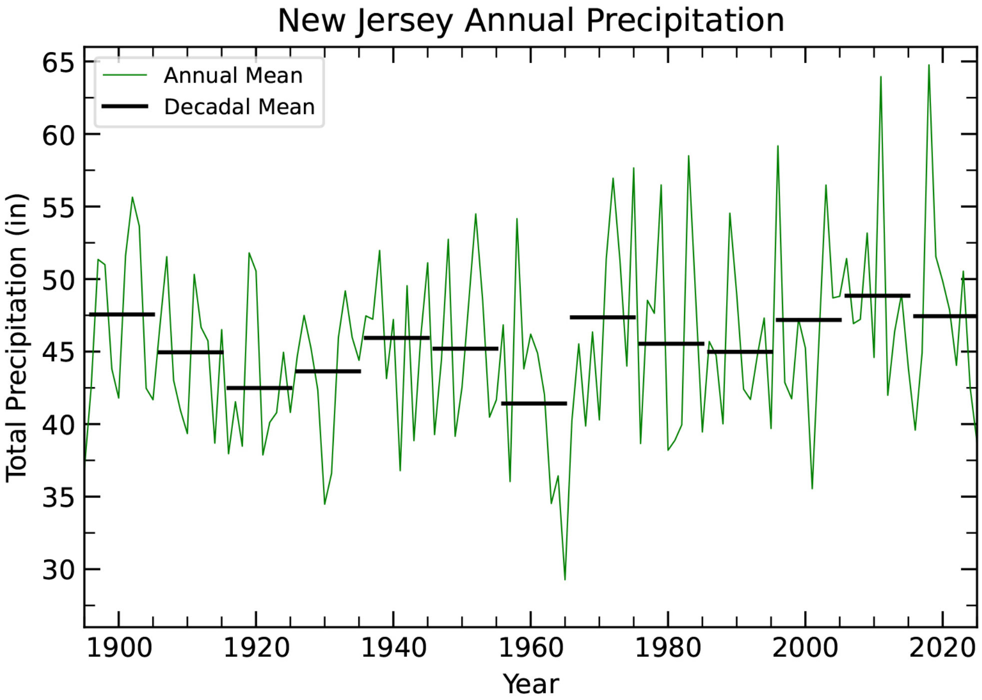
Table 3. Decadal averages of New Jersey average annual precipitation from 1896 to 2025. [Office of the New Jersey State Climatologist]

Decade	Average Precipitation (inches/yr)
1896–1905	47.56
1906–1915	44.95
1916–1925	42.49
1926–1935	43.64
1936–1945	45.94
1946–1955	45.20
1956–1965	41.42
1966–1975	47.36
1976–1985	45.54
1986–1995	44.98
1996–2005	47.18
2006–2015	48.85
2016–2025	47.44

Precipitation

Increasing temperatures allow the atmosphere to hold more water vapor, increase evaporation rates, and potentially produce more precipitation. [81] Due to the large year-to-year variability of precipitation, this report uses decadal averages to analyze long-term trends. Decadal average precipitation in New Jersey increased roughly 3–5 inches (~7%) since the late 1800s (Table 3, Figure 7). From 1895 to 1965, the average decadal precipitation was constrained between 42.49–47.56 inches/yr. Between 1956 and 1965, the mean fell (coincident with drought conditions) to 41.42 inches/yr. From 1966–2025, the decadal means were generally within a higher range of 44.98–48.85 inches/yr. Downscaled AR6 climate model data (accessed via the Applied Climate Information System, rcc-acis.org, managed by the Northeast Regional Climate Center, Cornell University) [57] project New Jersey to experience an increase in mean annual precipitation of 3–13% by the end of the century with both moderate and high emissions (similar to observed historical trends) compared to the 1991–2020 average. [55,56] Projected changes in annual precipitation by 2100 are smaller than the historic year-to-year variations in precipitation in New Jersey.

Figure 7. New Jersey annual precipitation (inches). [Office of the New Jersey State Climatologist]



Observed increased precipitation has been coupled with an increase in interannual variability (Figure 7). Pre-1970, the average of the top five wettest years was 54.14 inches, and post-1970 it was 60.81 inches (Table 4). The average of the driest five years was 34.15 inches and 38.00 inches for each period, respectively. This simple comparison elucidates that not only has annual precipitation been increasing, but that the range between the wettest years and driest years has also increased on average by ~2.82 inches. In effect, these measurements indicate that annual precipitation has become more variable from year to year, with some years fairly dry and others seeing excessive rainfall and snow. This trend is expected to continue, and the U.S. Northeast is projected to become wetter and experience greater precipitation variability by the middle and end of the 21st century. [54,81,82] A warming climate intensifies the hydrologic cycle, increasing precipitation variability globally, which can affect regional agricultural production, drought frequency, and flood conditions. [83] It should also be noted that precipitation patterns are naturally subject to high

Table 4. The 5 highest and lowest annual New Jersey precipitation amounts in inches pre- and post-1970 with averages of each and the range between average highs and lows. [Office of the New Jersey State Climatologist]

	Rank	1	2	3	4	5	Average	Range
Pre-1970	High	55.64	54.49	54.16	53.65	52.74	54.14	19.99
	Low	29.27	34.48	34.53	36.04	36.43	34.15	
Post-1970	High	64.76	63.95	59.18	58.50	57.66	60.81	22.81
	Low	35.55	38.20	38.66	38.72	38.88	38.00	

interannual, interdecadal, and locational variability, so recent increases in precipitation amounts may not be solely attributed to climate change.

New Jersey annual precipitation has increased more rapidly over the past 50 years compared to prior decades. Prior to 1961, annual precipitation amounts were effectively stable, displaying a small decreasing rate of -0.27 ± 3.40 inches/century. After 1961, the linear rate shifted to 10.34 ± 4.53 inches/century. When calculated relative to 1971, the linear rate decreased to -0.22 ± 5.66 inches/century. Since 1981, the linear rate increased again to 7.03 ± 7.48 inches/century and to 7.92 ± 10.95 inches/century since 1991. In general, the uncertainty ranges around each linear trend are large compared to the central value, emphasizing that large year-to-year rainfall variability is a dominant characteristic of New Jersey precipitation (Figure 7). The 1961–1970 period, it should be noted, experienced a large drought early in the decade that may over-influence the calculated long-term trend since 1961. The top five wettest years since statewide records commenced in 1895 have all occurred since 1975, with a maximum of 64.76 inches in 2018. The lowest recorded yearly precipitation was 29.27 inches in 1965 (severe drought conditions) while 2025 was the 4th driest post 1970 at 38.72 inches. When assessing these precipitation trends and their societal impacts, it is important to consider the balance between evaporation and precipitation. Evaporation also increases with higher temperatures, transferring water back into the atmosphere more rapidly, making less rainwater available for water storage, agriculture, and other uses. Although it is projected that precipitation may increase in New Jersey on average, increasing temperatures and water demand will result in drier soils less suitable for agriculture and more conducive for wildfires in forest environments.

In the Northeast, annual precipitation is expected to increase, especially during the winter season, [54,84] but combined with higher temperatures and evaporation rates, the duration of future summer dry spells is expected to lengthen. While the frequency of extreme precipitation has increased in New Jersey, [85] and this increase is expected to continue, [59,86–88] the periods between rainfall events in the summer are projected to be longer (i.e., reduced water resources), resulting in more short-term drought conditions and with greater average annual water deficits and lower capability to fulfill vegetation requirements. [81,89] Due to higher temperatures, these more frequent dry periods could require increased irrigation and residential water usage, risking saltwater intrusion in New Jersey aquifers and lowering groundwater levels (which can, in turn, result in processes like subsidence) due to freshwater pumping. [50,89]

Finally, as regional temperatures warm, the frequency of snowfall in the northeastern U.S. is expected to decrease while rainfall is expected to increase. [90] However, while the total amount of snow in a given season and the frequency of snowfall episodes may decrease as the climate warms, snowstorms are still possible. Due to the increased moisture availability in the atmosphere in a warmer climate along with weather processes, future snowstorms are likely to

Understanding Return Periods

Extreme events (primarily precipitation and flooding) are typically described in terms of return periods/intervals, such as the "T-year event." A 100-year event, typically referring to a flooding or extreme weather event, has a 1% or 1/100 probability of occurring each year at a specific location. Similarly, a 50-year event has a 2% or 1/50 probability of occurring each year at that location. A common misconception is that if a 100-year event occurred one year, it will not happen again for another 100 years. However, the probability remains at 1% each year no matter what happened in preceding years: a 100-year rainstorm in one year does not change the probability of receiving the same amount of precipitation the next. [97] Return period events are defined for a specific geographic scale (such as a point or a county). For example, in a given year, multiple 100-yr rainfall events may be recorded throughout New Jersey. Those events characterize the specific locations in which the rainfall occurred but not the state as a whole. Finally, with climate change, a 100-year intensity event may become a 50- or 20-year event in the future as extreme event frequencies change.

Note that what return period event is considered "extreme" depends on the type of event, but the 100-year event is a common threshold used within scientific and planning assessments.

The extreme events described by the return period projection can be captured in multiple ways. It is common to use an event from start to finish, such as the return period of a river flood elevation, in describing the return period. However, return periods can also be defined using the event duration. For example, the measured rainfall over 24 hours and the rainfall measured over 2 days at a location may both present extreme conditions and different amounts. But each measured timeframe (24 hours vs. 2 days) will have a separate set of return periods (e.g., the 10-yr return period of the 24-hour rainfall event is distinct from the 10-yr return period of the 2-day rainfall event). Finally, a 100-year rainfall event does not necessarily result in a 100-year flood because flooding is affected by several factors besides rainfall—the most important being ground saturation during a storm.

produce more snow, possibly increasing the frequency of future large snowfall events. [91] In this vein, much of New Jersey's heaviest snowfall has occurred since 2000 (such as 30.0 inches in Hudson County on January 23, 2016, or 29.8 inches in Union County on December 27, 2010). [92] These events have resulted from warming Arctic atmospheric temperatures and Arctic airmass excursions along the eastern U.S that increased the probability of heavy snowfall. [93]

Extreme Events

Extreme events can be defined as low probability of occurrence weather or climate events whose severity, magnitude, or impact exceed a threshold near the upper or lower ends of that type of event's historic range within a specific region.[94]

In New Jersey, a discussion of extremes often centers on heavy rainfall and flooding associated with large storms, such as a tropical cyclone. As sea level rises in New Jersey, so does the risk of coastal flooding from large coastal storms. Storm surges induced by tropical cyclones and nor'easters and their

More intense precipitation events will lead to more frequent and larger floods that can cause loss of life and property damage in New Jersey.

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potential damage are magnified by an increasing sea level. For example, it has been estimated that approximately 12.8% of the total property damage from Hurricane Sandy in New Jersey can be attributed to human-caused sea-level rise, representing about $3.7 billion. [95] Following this trend, a coastal storm affecting New Jersey today would cause more flooding damage than the same storm 50 years ago, and today's 100-year intensity coastal flooding event is projected to occur five times as often by 2050. [96]

Extreme precipitation events in the Northeast U.S. are becoming more frequent and intense. [54,59,98–100] Common practice is to use the NOAA Atlas 14 precipitation frequency estimates [101] for planning and design standards; however, this dataset ends in 2000. A recent study on extreme precipitation in New Jersey added weather station data through 2019 to the Atlas 14 data and found that most long-term weather stations throughout New Jersey have seen increases in the 2-, 5-, 10-, 25-, 50-, and 100-year return period precipitation events compared to the base Atlas 14 dataset. [85] At most locations, extreme precipitation amounts were found to be more than 2.5% greater than the 2000 dataset estimates. [85] This shift, by adding an additional 19 years of data, challenges a major assumption: that the past climate can accurately inform future expectations of extreme events. [102] It is therefore necessary that forward-looking metrics of extreme precipitation using historical data be supplemented by model projections to account for future climates.

More intense precipitation events will lead to more frequent and larger floods [89,103] that can cause loss of life and property/infrastructure damage in New Jersey. Flooding has compounding effects through avenues such as food and water supply contamination. [46,81,104] Extreme rainfall can increase water turbidity, which can affect river ecosystems and increase bacteria contaminants that, when ingested, may cause gastrointestinal illnesses. [46] Frequent and intense precipitation can also lead to soil saturation, which worsens agricultural outcomes by reducing plant growth or delaying planting and harvest. [50,105]

There are multiple ways in which extreme precipitation can be quantified and many studies offer different metrics to describe how the frequency of extreme precipitation has increased in recent decades. In the Northeast U.S., the frequency and severity of heavy precipitation events has generally increased over the period of 1958–2021. [54] This trend has resulted in an increase of total precipitation on the heaviest 1% of days by 60% and an increase in the five-year maximum daily precipitation by 18%. [54,86] Looking at this trend another way and expanding the year range to 1958–2022, the Northeast has seen a 49% increase in

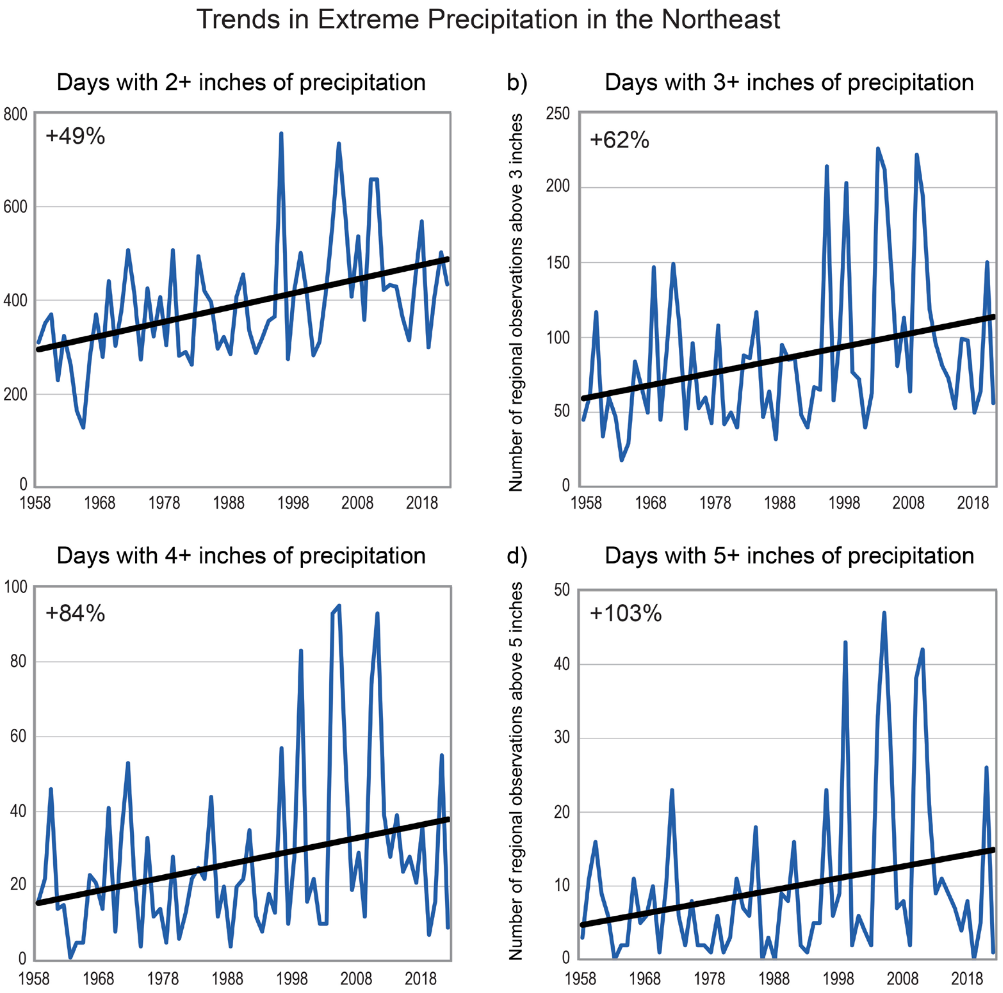


Figure 8. Four charts showing the annual number of days exceeding 2, 3, 4, and 5 inches of precipitation for the U.S. Northeast from 1958–2022 (blue lines). Numbers in the top left corner for each graph show the percent increase relative to the long-term average, computed as the difference between the end points of the trend lines (black lines) divided by the 1958–2022 average. Reproduced from the Northeast regional chapter of the 5th National Climate Assessment. [59]

the number of days with more than 2 inches of rainfall compared to the long-term 1958–2022 average and an 84% increase in days with more than 4 inches of rainfall compared to the long-term 1958–2022 average (Figure 8). [59]

The observed increase in extreme precipitation is not unique to the Northeast. Nationally, since the 1990s, individual precipitation events exceeding the 5-year return period have occurred 20–40% more frequently, and over 40% more frequently between 2006 and 2016. [86] At most U.S. weather stations, increasing extreme precipitation frequency can be directly attributed to increasing temperatures. [106] Greater temperatures increase the atmosphere's water-holding capacity and result in more frequent extreme precipitation. [107] Nationally, extreme precipitation events are projected to become more intense and frequent over mid-latitude regions (most of the continental U.S.), where atmospheric temperatures are expected to warm with climate change at higher rates compared to other regions. [1] The result is that, across much of the continental U.S., the projected temperature increase will produce greater atmospheric water availability for extreme rainfall.

Future projections of extreme precipitation within New Jersey indicate an increase in the amount of precipitation associated with the extreme 2-yr, 10-yr, and 100-yr 24-hour rainfall events. [87] The 24-hour event is the amount of rainfall or liquid water equivalent of snow/ice that is accumulated in a 24-hour period. The 2-yr, 10-yr, and 100-yr return periods here represent the frequency at which the accumulated precipitation for a given 24-hour period is expected to occur. Assuming moderate emissions, the median precipitation amount projection of the 100-yr 24-hour event will increase modestly by 2.5–10% in central and coastal New Jersey and by a larger 20–25% in northern New Jersey by the end of the century. Higher frequency events, such as the 2-year and 10-year 24-hour events, are projected to have an average increase in precipitation of 7.5–15% by 2100. [87] It should be noted that these increases in precipitation are median estimates of large ranges of possible change. Regardless of the magnitude of the projected changes, the likely trend throughout the rest of the century is for large precipitation events (such as the 100-yr 24-hour event) in New Jersey to increase in both frequency and the amount of precipitation.

Considerations for Risk Management

The scope of this report is primarily concerned with average trends or the likely range of projections of temperature, precipitation, and sea-level rise from model simulations. However, risk management necessitates considerations of extreme events that may not be adequately captured within these modeled ranges. Modeled projection ranges and averages often cannot capture changes to localized extremes, and relying on these likely ranges may lead to an underestimation of vulnerability to various climate hazards. As an example, Post-Tropical Cyclone Ida in 2021 delivered intense rainfall throughout much of the state, with Hillsborough (Somerset County) and Flemington (Hunterdon County) receiving more than 9.00 inches of rainfall and the Newark weather station registering Ida as the 1,000-year recurrence event while many weather stations around the state exceeded their 100-year recurrence interval rainfall amounts. [108] An Ida-like event is not captured in the modeled ranges described by the general projected change in average rainfall, and even simple analyses of projected extremes can miss these high impact but low likelihood events. As the climate continues to warm, New Jersey may become more susceptible to these extreme events, and compound events, whose intensity may outpace the linear increase expected from the modeled ranges and averages. [87,109]

Similarly, a formal risk analysis must consider both potential tipping points and cascading impacts. Regarding sea-level rise, Kopp et al. (2025) provides likely ranges of sea-level rise in New Jersey but note that the upper range of sea-level rise is dependent on instabilities in Antarctic ice sheet melt that are currently less well understood. [68] A risk management approach may wish to consider sea-level rise that incorporates these tipping point elements that might cause accelerated sea-level rise of 4.5 feet or higher by 2100. Furthermore, individual hazards may have cascading impacts, where an initial event triggers secondary or tertiary disruptions that can affect other natural, social, or economic systems. For example, in 2023, extreme heat and drought conditions in Canada resulted in wildfires that destroyed forests but also generated smoke that affected the air quality throughout the United States, including New Jersey, driving increased hospitalizations for asthma. [110] It is difficult to account for these cascading impacts and how they will change in the future.

Ultimately, while average projecting ranges are presented within this report, outcomes outside the range of climate models and assessment reports cannot be ruled out of risk management considerations.

Extreme Events: June 22–26 Heat Wave in New Jersey

In late June 2025, a prolonged extreme heat event affected New Jersey and much of the eastern United States. From June 22 through June 26, a combination of exceptionally high temperatures and humidity produced hazardous conditions across the state, with widespread daytime highs reaching into the upper 90s and lower 100s, with heat index values exceeding 100 °F. [30] The timing in early summer was notable as populations are typically less acclimatized to extreme heat in June, meaning the heat-related health impacts could be more pronounced.

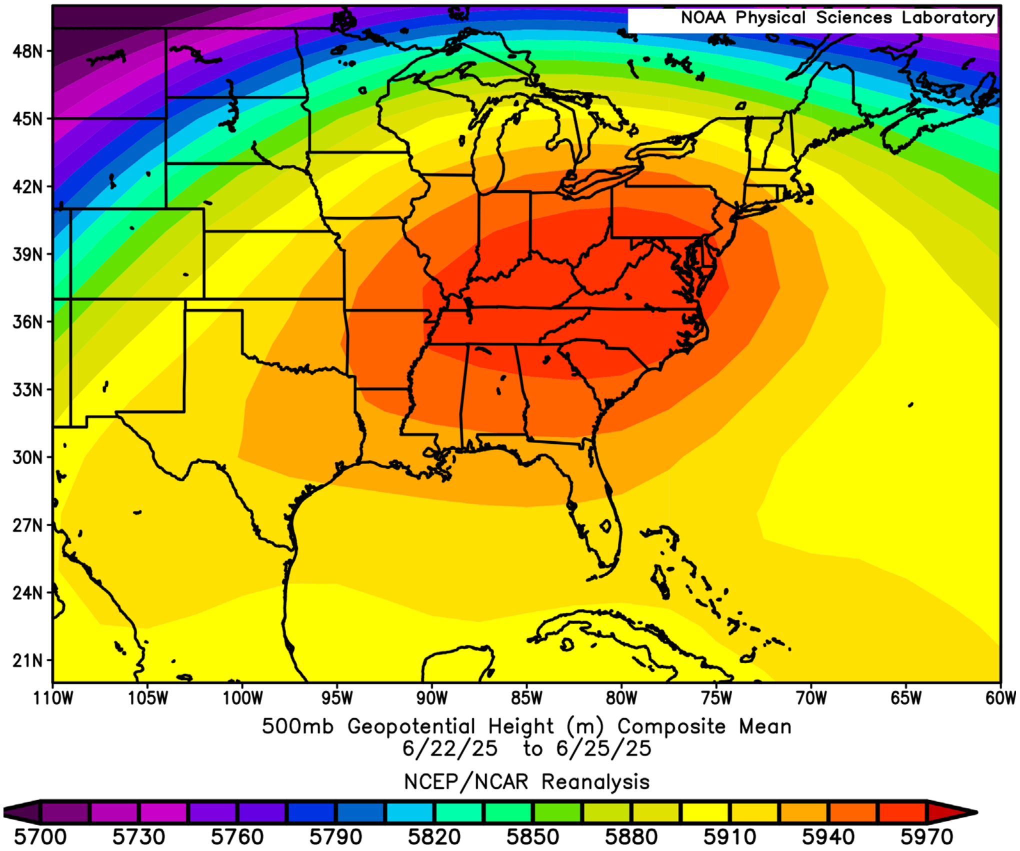
Climatologically, June 2025 was warm across the Northeast, with New Jersey recording an average monthly temperature of 71.9 °F, ranking in the top 10 warmest Junes on record. [109] The latter portion of the month saw a sharp transition from near-normal or even slightly below-normal temperatures earlier in June to significantly above-normal conditions during the final week coincident with the heat wave. Nationally, the event contributed to June 2025 being ranked as the 7th warmest June on record in the United States, [110] showcasing the large-scale extent of the heat event.

The heat wave had widespread and cascading impacts across New Jersey, affecting public health, infrastructure, and daily life. Due to the combination of extreme temperatures and high humidity, the event created dangerous conditions across both urban and rural areas, with particularly severe consequences for vulnerable populations. The danger was further exacerbated by persistently high nighttime temperatures, which limited overnight cooling and increased cumulative heat stress on human populations, the environment, and infrastructure.

Meteorological Drivers

The June 2025 heat wave was driven by a persistent and anomalously strong high-pressure system, commonly referred to as a “heat dome,” that became established over the eastern half of the United States. This system acted to suppress cloud formation and inhibit vertical air exchange, allowing the sun to continuously heat the land surface over multiple days (Figure 9). The air beneath

Figure 9. The June 22–25, 2025 high pressure system at 500mb (middle layers of the atmosphere) acted as a dome or cap, allowing heat to build up at the Earth's surface. Reproduced from NOAA Physical Sciences Laboratory. [114]



the high-pressure system sank and compressed, warming further. [113] This stagnation of the atmosphere allowed heat to build and persist across the region, rather than being dissipated by typical weather systems.

In addition to the high-pressure system, moisture transport, which is the movement of water vapor in the air, played a critical role in intensifying the event. Southerly winds circulating around the western edge of the high-pressure system transported warm, moist air from the Gulf of Mexico and Atlantic Ocean northward into the Mid-Atlantic and Northeast. [111] Dew points, the temperature at which water droplets start to condense, during the event reached the mid-70s to low 80s °F, increasing atmospheric humidity. [113] The combination of high temperatures and elevated moisture levels produced dangerous "wet heat" conditions, in which the body's ability to cool itself through sweating is reduced. As a result, heat index values, a measure of discomfort due to temperature and humidity, frequently exceeded 105 °F and, in some locations, approached 110 °F during the peak of the event (Figure 10, next page). [108]

Another key feature of the event was the elevated nighttime temperatures. Typically, temperatures drop overnight as the surface cools and heat is radiated into the atmosphere. However, the high humidity and heat dome limited cooling, resulting in unusually warm overnight lows. In Newark, temperatures remained above 80 °F for multiple consecutive nights, tying record streaks, while other locations across the region experienced similarly elevated minimum temperatures. [114,115] These warm nighttime conditions significantly increased heat stress, as they prevented both people and infrastructure from recovering from the daytime heat. [116]

The heat wave continued until a breakdown in the atmospheric pattern allowed cooler temperatures to arrive after four days of immense heat. As the high-pressure system weakened and shifted, cloud cover, showers, and thunderstorms moved into the region. This transition allowed cooler air to enter the region and disrupt the stagnant conditions supporting the prolonged heat.

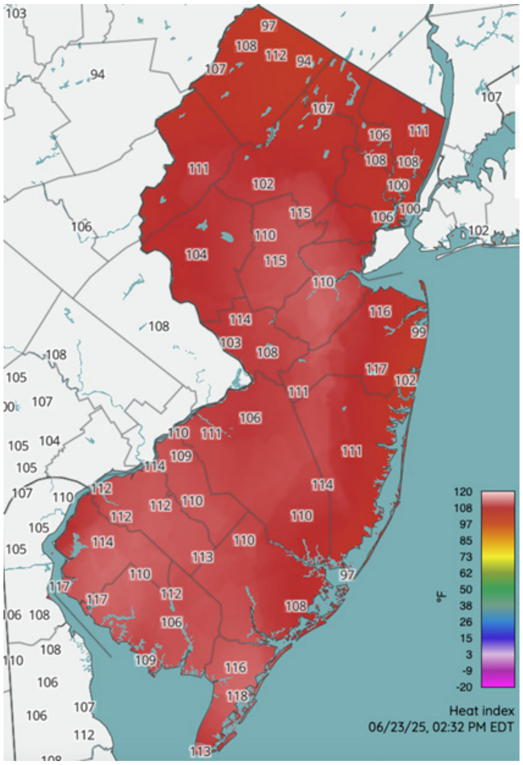


Figure 10. Heat index at 2:30 PM on June 23rd based on NJWxNet, NWS, and Delaware Environmental Observing System Network (DEOS) professional weather stations. Reproduced from the Office of the New Jersey State Climatologist. [117]

By the Numbers: Localized Temperature Extremes

The June heat wave produced widespread and record-breaking temperatures across New Jersey. The most intense conditions occurred between June 23 and June 25, when temperatures exceeded 100 °F at numerous stations across the state. [114] At least 34 stations recorded temperatures between 100 °F and 102 °F during the event across both inland and coastal regions. [114,115]

One of the most notable records occurred at Newark Liberty International Airport, where a high temperature of 103 °F was recorded on June 24 (Table 5, next page). This value tied the hottest June temperature ever observed at that location and represented the highest temperature recorded there since June 30, 2021. [30] In addition to extreme daytime highs, record-breaking nighttime temperatures were also observed. Newark recorded the highest ever overnight temperature of 85 °F on June 25, establishing the warmest June minimum temperature on record at that station. [30]

Other locations across the state experienced similar extremes. Stations in central and southern New Jersey, including Hammonton, Toms River, and Woodland Township, also recorded temperatures at or above 103 °F on June 24. [114] In addition to peak temperatures, the duration of extreme heat was a defining characteristic of the event. Atlantic City Airport recorded temperatures at or above 100 °F for two days. Newark recorded three consecutive days with temperatures at or above 100 °F, especially rare in June. [115] Temperatures

Table 5. High Temperatures across New Jersey during the June 2025 Heat Wave. [120,121]

Location	Recorded Temp	Date
Camden	104.2 °F	June 24
Newark	103 °F	June 24
Toms River	103 °F	June 24
Atlantic City	102 °F	June 24/25
Trenton	101 °F	June 24
New Brunswick	100 °F	June 24
Cape May	100 °F	June 24

reached or exceeded 90 °F on at least fifteen days during June 2025 at one or more stations across the state. [114] The effects of the heat wave were felt even more strongly in cities, where daily high temperatures were generally greater than suburban, rural, or forested regions (e.g., Camden, Figure 11, next page). Overnight temperatures in the urban areas also did not generally cool as much as exurban areas, increasing heat exposure for urban residents.

Cascading Statewide Impacts

One of the most significant impacts of the heat wave was on public health. A wide range of diseases are influenced by climate variability, including cardiovascular and respiratory illnesses as well as mental health disorders. [122]

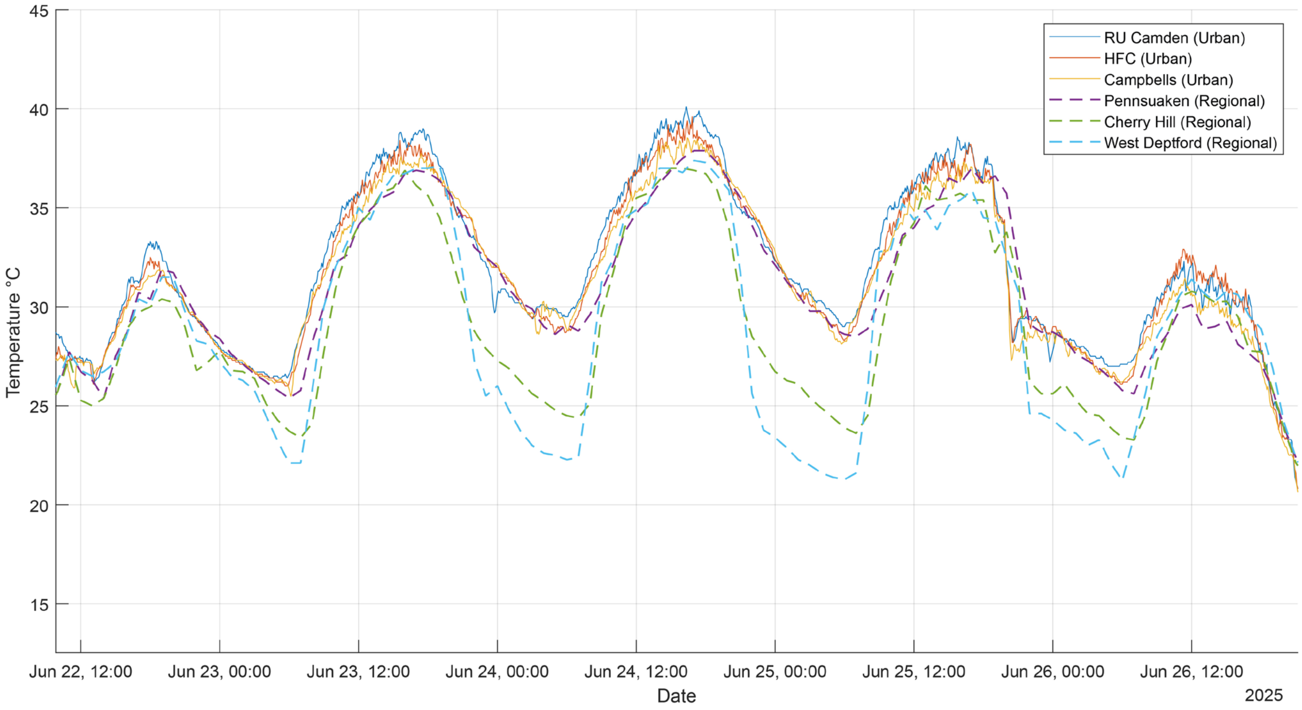
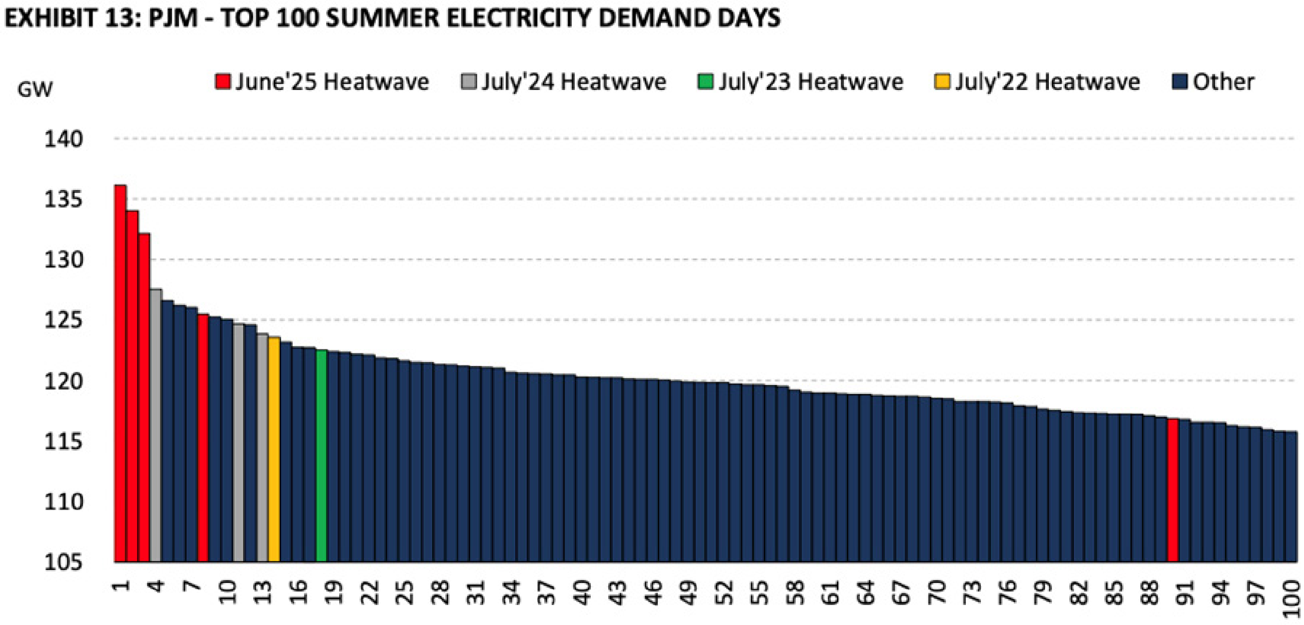


Figure 11. Temperature observations during the June heat wave at three urban and three regional weather stations in and around Camden, New Jersey.

During the peak of the heat wave, an outdoor high school graduation ceremony in Paterson (Passaic) resulted in a mass casualty incident as more than 150 individuals experienced heat-related illnesses, including heat exhaustion and dehydration. Emergency medical services were overwhelmed, and multiple individuals required hospitalization, prompting local officials to declare a state of emergency and open cooling centers to protect residents. [123]

Infrastructure systems across the state were strained by the extreme heat. Elevated temperatures caused sections of roadway to buckle due to thermal expansion, disrupting traffic and requiring emergency repairs. [121] Rail systems were similarly affected, with transit agencies implementing speed restrictions and delays to prevent damage to tracks and equipment under extreme heat conditions. [122] The electrical grid experienced significant stress as demand for air conditioning surged across the region. Pennsylvania-New Jersey-Maryland (PJM) Interconnection saw an increasing electricity demand (Figure 12, next page) associated with the elevated usage. Energy providers reported increased electricity usage, and grid operators, including PJM, issued alerts to manage peak demand and maintain system reliability. [123] In the New York City metro area, power outages occurred, further compounding the risks associated with extreme heat by limiting access to cooling.[65]

Urban areas experienced intensified conditions due to the urban heat island effect, which is when built environments with concrete and asphalt retain heat more effectively than vegetated areas. As a result, densely populated cities such



Source: EIA Hourly Grid Monitor

Figure 12. Top 100 Summer Electricity Demand Days for PJM. Reproduced from Energy Ventures Analysis (2025). [126]

as Newark and Paterson faced higher temperatures and reduced nighttime cooling compared to surrounding regions. Vulnerable populations, including low-income communities, outdoor workers, and individuals without access to air conditioning, are disproportionately affected by these conditions. [127]

Climate Change Context and Future Projections

In the case of the June 2025 event, large portions of the eastern United States experienced temperatures several degrees above average, consistent with broader warming trends observed across the region. [54,59] According to Climate Central's Climate Shift Index, all of New Jersey reached a Level 5 classification during the heat wave, indicating that climate change played a significant role in the severity of this event. [125]

In addition to increasing the likelihood of heat waves, climate change is intensifying their severity, leading to higher peak temperatures and reduced nighttime cooling. Recent analyses of the June 2025 event suggest that similar atmospheric conditions that produce this type of heat wave now occur in an environment that is approximately 1.5 °C warmer and more humid than in the mid-20th century. [113] This added warmth enhances both daytime temperatures and atmospheric moisture content, contributing to more dangerous "wet heat" conditions. Additionally, observations show that overnight low temperatures are rising more rapidly than daytime highs in many regions, including the northeastern U.S. [126] This trend reduces the ability for temperatures to cool overnight, increasing cumulative heat stress.

Looking forward, projections indicate that extreme heat events will continue to become more frequent, longer lasting, and more intense.[54] With a projected warming of 2 °C, there will be more hot days, even warmer nights, and fewer cold days (Figure 13). The average heat wave season in the United States has lengthened by approximately 20 days since the 1990s and is expected to expand further under continued warming.[127] As a result, early-season heat waves like the June 2025 event may become increasingly common, posing challenges for public health preparedness, infrastructure resilience, and energy demand.

Ultimately, the June 2025 heat wave serves as a clear example of the growing risks associated with extreme heat in New Jersey. By combining lessons from this event with historical trends and climate projections, decision makers can better prepare for a future in which extreme heat events are more common, more intense, and more impactful across the state. The New Jersey Extreme Heat Resilience Action Plan outlines a framework for addressing these heat related challenges, including improving early warning systems, expanding cooling infrastructure, and integrating heat risk into urban planning and public health policies.[131] The plan emphasizes actions such as expanding the number of cooling centers in high-risk communities and improving access to real-time heat alerts through early warning systems. Additionally, it encourages integrating heat risk into urban planning by increasing tree canopy and green spaces in densely populated areas that are most affected by the urban heat island effect. Continued investment in these strategies will be critical to reducing future impacts.

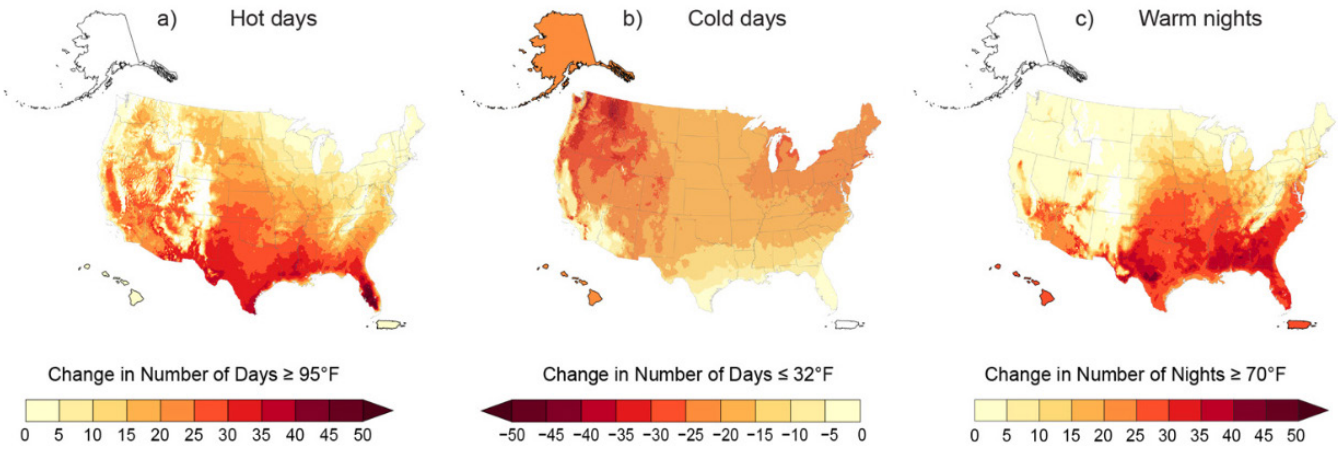


Figure 13. Maps of the U.S. showing changes in the (a), projected number of hot days with a maximum temperature at or above 95 °F, (b) cold days (minimum temperature at or below 32 °F), and (c) warm nights (minimum temperature at or above 70 °F) at a global warming level of 2.0 °C compared to preindustrial (1850–1899) conditions. For comparison, on average, the decade of 2012–2021 was approximately 1.1°C warmer than preindustrial conditions. Reproduced from Marvel et al. (2023).[54]

Indicators of Climate Change in New Jersey and Surrounding Regions

Climate change indicators, metrics or observations that represent the change in environmental conditions, provide accessible climate change information to communities to improve awareness and promote mitigation and adaptation efforts. While global and regional climate can be expressed in terms of changes in annual temperatures or satellite information presented at the national to global scales, contextualizing local effects by presenting changes in regional climates [129,130] can more effectively communicate potential impacts. One way of doing this is by looking at "human scale" indicators, those that are noticeable to individuals, of climate change such as local observations of temperature, lake ice, plant bloom, and winter severity. The recently published *Diverse Indicators of Climate Change for New Jersey and Vicinity* study explores how non-traditional indicators have changed and how they can inform potential impacts in the New Jersey region. [131] Specifically, the team analyzed the annual number of days with extreme daily maximum and minimum temperatures, days with cold temperatures, an index of winter severity, trends in sea surface temperatures, the approximation of phenological spring onset from lilac annual first leaf and first bloom, and the annual duration of lake ice cover at two locations. These indicators were selected to translate long-term climate data into a relevant context for the communities within New Jersey and its vicinity, especially in terms of economic and health impacts. [132,133] These indicators were measured at multiple locations in New Jersey and the surrounding vicinity:

The increase in annual temperatures in New Jersey coincides with an increase in hot days and nights, with weather stations in central New Jersey experiencing about 22 more days per year with daily high temperatures exceeding 90 °F since 1967 (Table S1, next page). Warm nights (those above 70 °F) have similarly become more frequent at a rate of about 2.64 days per decade across the state, or about 14.52 more days per year since 1967 (Table S1). The increase in these hot days and nights produces a higher risk of heat-related morbidity and disrupted sleep, which worsens overall health outcomes. [134,135] The extreme heat disproportionately affects vulnerable populations, such as communities of color or low-income communities, by worsening public health outcomes from greater heat stress and worsening air quality, such as higher concentrations of ground-level ozone and $PM_{2.5}$.

A warming climate also affects ocean temperatures. Higher sea surface temperatures have changed the range of habitats and of commercially and recreationally important marine species off the Mid-Atlantic and Northeast U.S. coastlines. Black seabass, scupper, American lobster and sea scallops are expected to move farther north, following cooler

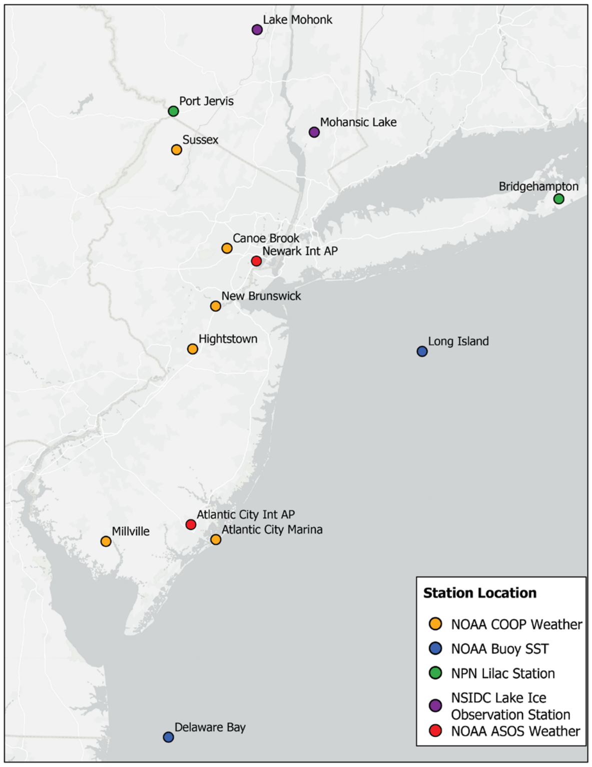


Figure S1. Location and types of measurements for indicators. Adapted from Cornish et al. (2026). [134]

Station Name	Maximum ≥ 32.2 °C (90.0 °F)	Minimum ≥ 21.1 °C (70.0 °F)	Maximum ≤ 0.0 °C (32.0 °F)
Atlantic City Marina, NJ	0.04	6.64	-1.58
Canoe Brook, NJ	4.35	4.14	-2.32
Hightstown, NJ	4.15	-0.01	-2.07
Millville Municipal Airport, NJ	1.77	0.63	-1.45
New Brunswick 3 SE, NJ	3.99	2.71	-2.66
Sussex 3 WNW, NJ	1.23	0.81	-1.71
Newark International Airport, NJ	2.64	2.02	-1.86
Atlantic City International Airport, NJ	2.48	4.17	-1.91
Average	2.58	2.64	-1.95

Table S1. NOAA Weather Stations and Associated Trends in Annual Temperature Metrics in Days per Decade from 1967 to 2022.

waters. [139–141] The change in distribution of these key species can affect commercial fishers as they need to travel further afield for their catch. These warmer ocean temperatures also provide better environments for the development of harmful algal blooms, which can harm local marine life and introduce toxins into fish and shellfish, reducing viable catch for commercial and recreational fishing. [142]

Conversely, winter temperatures and severity are decreasing. The number of very cold days (those with daily highs below freezing, 32 °F) have decreased by 10.73 days per year since 1967 (Table S1). Milder temperatures allow disease vectors like mosquitoes that carry West Nile Virus to better overwinter and expand their range and active seasons. [49,64,140] Additionally, warmer winters can extend the growing season, allowing for more production or new crops in the region, but also extend the pollen allergy season. For example, the records of spring lilac first leaf and bloom in the region have shifted earlier by about two weeks since 1967 (Figure S2). However, this shift in bloom times can lead to a “false spring” hazard where earlier bloom can leave a crop like blueberries vulnerable to late season frosts. [52]

Warmer winters will also decrease the likelihood of winter snowfall and its persistence on the ground, affecting winter recreation and the businesses that service winter tourism. [90,143]

A reduction in winter lake ice is expected to drastically change underlying lake ecosystems in the region as consistently warmer waters can affect the health of lake fish species. [144,145] Furthermore, recreational lake activities like ice fishing or ice skating may be more difficult, if not impossible, to pursue in the future because ice is either too sporadic or too thin to carry out these activities.

Ultimately, the usage of indicators such as these translates the often-abstract global data into a more community impact-centric context for climate change. While a shift in annual temperatures can be difficult to conceptualize, a dramatic increase of extreme hot days, a loss of almost 11 cold days per year on average, or a two-week earlier arrival of spring fundamentally changes the characterization of New Jersey’s climate identity. This change is of importance to many of the state’s sectors, like agriculture, fisheries, and recreation/tourism, as a warm climate can bring about a mix of economic benefits and disbenefits. For the state’s public health sector, an increase in hot extremes will present new challenges for healthcare providers that may necessitate modifications to existing systems of care. Within this context, one can more readily interpret the effect of climate change on New Jersey’s communities and can help provide the context for developing adaptation solutions.

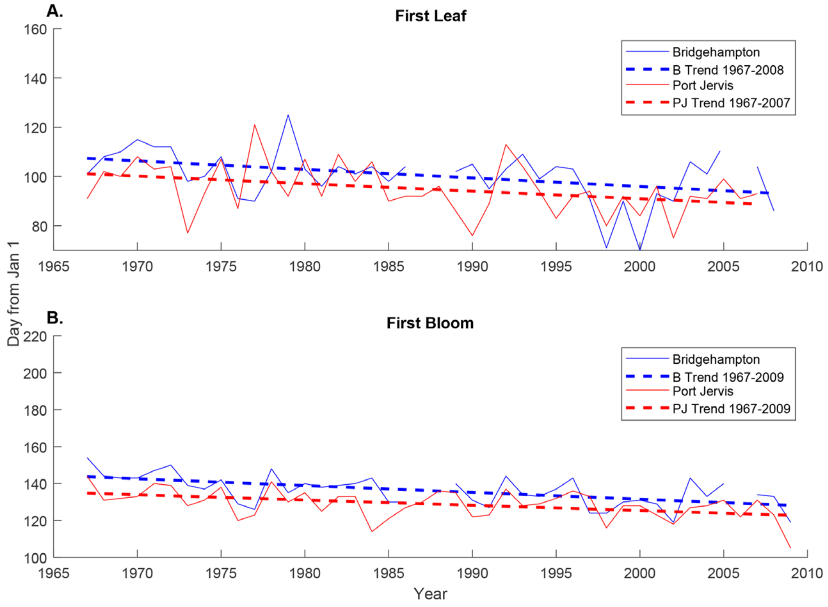


Figure S2. Annual day of S. *x chinensis* (“Red Rothomagensis”) Lilac (**A**) first leaf and (**B**) first bloom as indicators of the onset of spring at Bridgehampton, Long Island, NY (blue line) and Port Jervis, NY (red line). Dashed blue and red lines represent the associated linear trend in the first leaf and bloom at each station for the period of record. Adapted from Cornish et al. (2026)

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Appendix A

Table A1. Publicly Available Datasets used in this Report and the URLs for Access

Data Type	Organization	Data Source URL
Atmospheric Carbon Dioxide Concentrations Measured at Mauna Loa	NOAA Global Monitoring Laboratory	https://gml.noaa.gov/ccgg/trends/
Global Land-Ocean Temperature Index Anomalies	NASA's Goddard Institute for Space Studies; NASA Global Climate Change Vital Signs of the Planet	https://climate.nasa.gov/vital-signs/global-temperature/
New Jersey Climate Data	Office of the New Jersey State Climatologist	https://njclimate.org
Atlantic City Relative Sea Level Rise Trend	NOAA Tides and Currents	https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?id=8534720
Projected Changes in Extreme 24h Rainfall Events	NJ Department of Environmental Protection; Northeast Regional Climate Center, Cornell University	https://www.nj.gov/dep/dsr/publications/projected-changes-rainfall-model.pdf
Parameter-elevation Regressions on Independent Slopes Model	Oregon State University	https://prism.oregonstate.edu