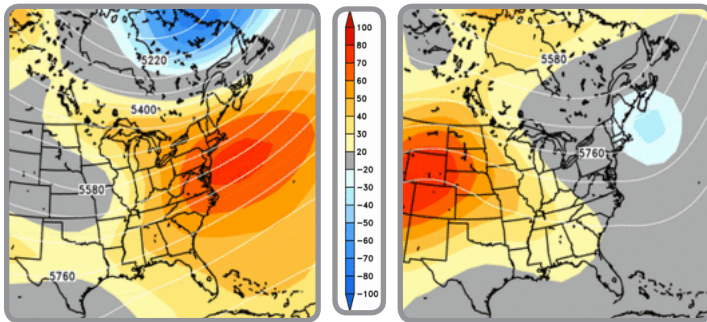
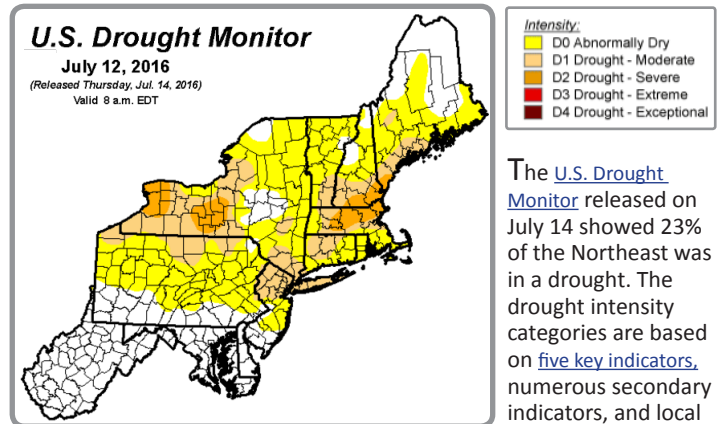


Weather Patterns & Drought Monitor



Maps of monthly average upper-level (500 mb) circulation patterns and anomalies (in meters). Ridging occurred over the eastern U.S. in March (top left), while a trough was present over the Northeast in June (top right). Credit: NOAA.



Intensity:
 D0 Abnormally Dry
 D1 Drought - Moderate
 D2 Drought - Severe
 D3 Drought - Extreme
 D4 Drought - Exceptional

The [U.S. Drought Monitor](#) released on July 14 showed 23% of the Northeast was in a drought. The drought intensity categories are based on [five key indicators](#), numerous secondary indicators, and local reports from expert

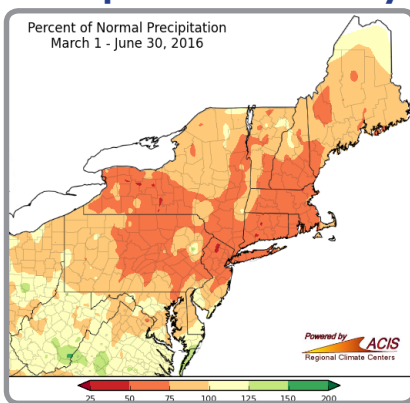
In March, a stronger-than-normal Bermuda High weakened low pressure systems as they moved through the eastern U.S., contributing to drier-than-normal conditions. A combination of dry Canadian air masses and upper-level ridges led to below-normal precipitation in April and May. Dry conditions continued in June. The weather pattern featured an upper-level trough much of the month, which helped keep the drought from becoming worse. Low relative humidity, windy conditions, and warm temperatures contribute to greater evaporation, but the biggest contributor is increased solar radiation due to clear skies, which the region also experienced.

observers. Droughts in the Northeast tend to be seasonal, lasting less than 6 months. The current drought is expected to be seasonal. Seasonal droughts are more common than the severe drought of the mid-1960s, which persisted for several years.

The current drought is focused in three main areas. Drought conditions have occurred in Essex County, MA seven of the past 17 years, with a drought every year since 2012. Tompkins County, NY, is experiencing a severe drought for the first time since the U.S. Drought Monitor began in 2000. Bergen County, NJ has experienced drought conditions nine of the past 17 years, with extreme drought in 2002.

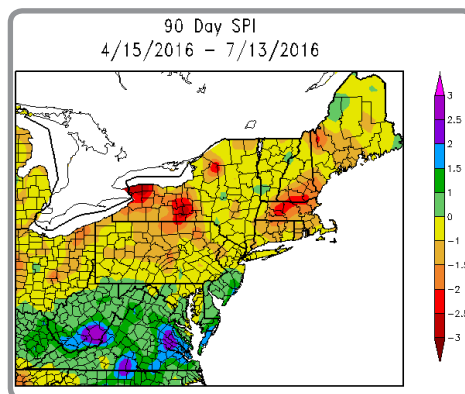
Precipitation

Precipitation Anomaly



A majority of the Northeast is experiencing below normal precipitation departures. Precipitation from March through June has been below 75 percent of normal for all of Rhode Island and a majority of Connecticut and Massachusetts. Connecticut has had 10.07 inches of precipitation during this time period, which is only 59 percent of normal. Large areas of New York, Vermont, New Hampshire, New Jersey, and Pennsylvania have also had less than three quarters of their normal precipitation amounts. In contrast, parts of West Virginia had record-breaking rainfall in June.

Standardized Precipitation Index



The [Standardized Precipitation Index \(SPI\)](#) was negative over the last 90 days, indicating dry conditions, for portions of the Northeast. The SPI uses historical station data to calculate the probability of a precipitation event. The index value directly corresponds to the standard deviation based on the historical data and can be directly related to U.S. Drought Monitor categories. A larger negative value indicates drier conditions. Areas in central and western New York have SPI values of -2 to -3. SPI values this low are expected to occur fewer than two times in 100 years.

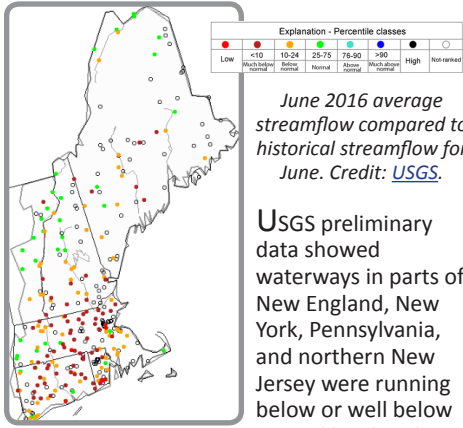
Records

Station	March - June Precipitation (inches)			
	2016	Normal	% of Normal	Rank
Lawrence, MA	7.96	17.46	46	6
Elmira, NY	6.30	13.21	48	1
Flemmington, NJ	8.98	17.83	50	3
Batavia, NY	6.22	12.17	51	1
Kennedy Airport, NY	7.95	15.45	51	1
Ithaca, NY	6.94	13.11	53	1
Point Jervis, NY	8.55	16.10	53	3
Norfolk, CT	9.98	18.07	55	4
Amherst, MA	8.94	15.68	57	5
Otter Brook Lake, NH	8.95	15.35	58	3
Glen Hazel Dam, PA	10.50	15.97	66	4
Tully Lake, MA	10.59	15.63	68	5
Barre Falls Dam, MA	10.90	15.90	69	8
West Rockport, ME	14.29	18.29	78	8

The lack of precipitation from March through June has broken records in New York. Elmira, Batavia, Kennedy Airport, and Ithaca have had their driest March through June period on record. Other reporting stations from Pennsylvania to Maine have ranked in their top five or top ten driest for the same time period. Lawrence, MA only had 46 percent of their normal precipitation. June was particularly dry. Batavia's June rainfall only totaled 0.60 inches, ranking as their second driest June, and Lawrence had a similarly low total of 0.62 inches, ranking as their fourth driest. Ithaca had their second driest June with 1.07 inches.

Impacts

Water Resources



June 2016 average streamflow compared to historical streamflow for June. Credit: [USGS](#).

USGS preliminary data showed waterways in parts of New England, New York, New Jersey, and northern New Jersey were running below or well below normal levels in late

June and early July, with near to record low 1-, 7-, 14-, and 28-day average streamflows on some waterways. Groundwater was also at below to well below normal levels.

June reservoir levels in Massachusetts were generally near to below normal. The reservoir system for the city of Worcester, MA was at 85.3% of capacity on June 1, marking the lowest June 1 capacity since 1966. As of July 1, reservoir capacity was at 75.3%. Despite dry conditions, most of the reservoirs that provide water to the New York City metro area were at near normal levels.

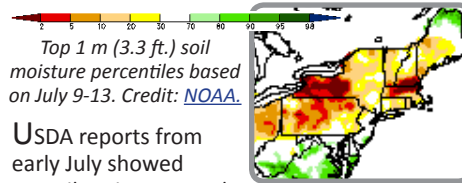


Credit: City of Worcester, MA

Fire Danger

The fire danger rating is usually low once greenup (when leaves appear on plants) occurs in June, but this year dry conditions led to an above-normal number of days with a fire danger rating of moderate or higher. The number of fires once greenup arrived has also been above normal in parts of the region. Information compiled by NWS Burlington indicated that larger fires were burning deeper into the ground and were taking longer than normal to suppress in Maine and Massachusetts.

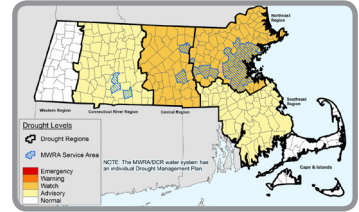
Agriculture & Forestry



USDA reports from early July showed topsoil moisture rated short or very short for 51% of New York and 60% of New England, while subsoil moisture rated short or very short for 47% of New York and 56% of New England. Many farmers irrigated as the dry conditions hindered growth and stressed crops. For example, pastures were stunted and corn was curling in parts of central New York. Several farms in northeastern Massachusetts reported crop losses due to non-irrigated fields being too dry to plant or seed sprouts not emerging after planting.

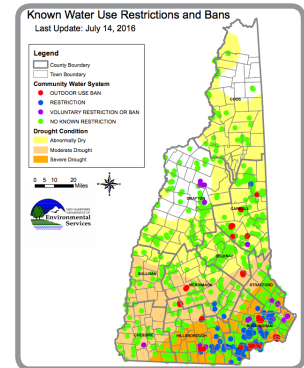
A fungus that kills gypsy moth caterpillars needs springtime moisture to grow. Without adequate rainfall, the caterpillar population thrived and in turn decimated tree foliage in Massachusetts, Rhode Island, and Connecticut. The defoliated trees also heightened fire danger because more sun is able to reach the forest floor, creating drier conditions that contribute to the rapid spread of fire.

Drought Advisories



Connecticut issued a [Drought Advisory](#) on June 27, asking residents to conserve water. The state most recently declared a Drought Advisory in 2010. On July 8, a [Drought Watch](#) was declared for central and northeastern Massachusetts and a Drought Advisory was declared for southeastern Massachusetts and the Connecticut River Valley (map above). The most recent Drought Advisory was during Fall 2014, while the most recent Drought Watch was 2002. Both states use precipitation, streamflow, groundwater, fire danger, Crop Moisture Index, and reservoirs as drought indicators. Additionally, Massachusetts uses SPI, while Connecticut uses Palmer Drought Index.

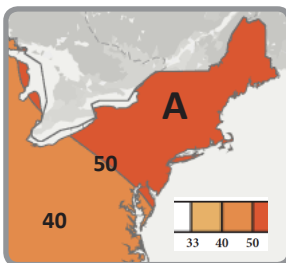
Voluntary and mandatory water restrictions were implemented in numerous towns in New England and New York.



Outlooks

Temperature and Precipitation

Valid for July–September



A: Above-normal
#: Probability of above-normal

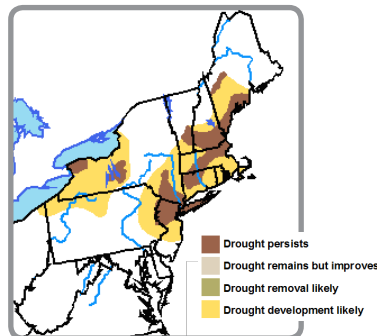
NOAA's Climate Prediction Center (CPC) is forecasting an increased chance of

above-normal temperatures for the Northeast (map above) for July–September.

As for precipitation, equal chances were forecast for the entire region for July–September. According to CPC, "equal chances are forecast in areas where the likelihood of seasonal accumulated precipitation amounts are expected to be similar to climatological probabilities."

Drought & Wildland Fire

Valid for July 2016



The NOAA Climate Prediction Center's Monthly Drought Outlook for July (above) calls for drought conditions to persist or develop in parts of the Northeast.

There is near normal potential for significant wildland fires for most of the region this summer, according to the [National Interagency Fire Center](#).

Regional Partners

National Oceanic and Atmospheric Administration
www.noaa.gov

National Centers for Environmental Information

www.ncei.noaa.gov

National Weather Service

www.weather.gov

NOAA Research, Climate Program Office and Geophysical Fluid Dynamics Lab

www.research.noaa.gov

NOAA's North Atlantic and Great Lakes Regional Collaboration Teams

www.regions.noaa.gov

Climate Prediction Center

www.cpc.ncep.noaa.gov

Northeast Regional Climate Center

www.nrcc.cornell.edu

National Integrated Drought Information System

www.drought.gov

Northeast Region State Climatologists

www.stateclimate.org

USDA Northeast Regional Climate Hub

www.climatehubs.ocs.usda.gov/hubs/northeast