

MASSACHUSETTS WATER RESOURCES COMMISSION

JULY

2021

HYDROLOGIC CONDITIONS IN MASSACHUSETTS



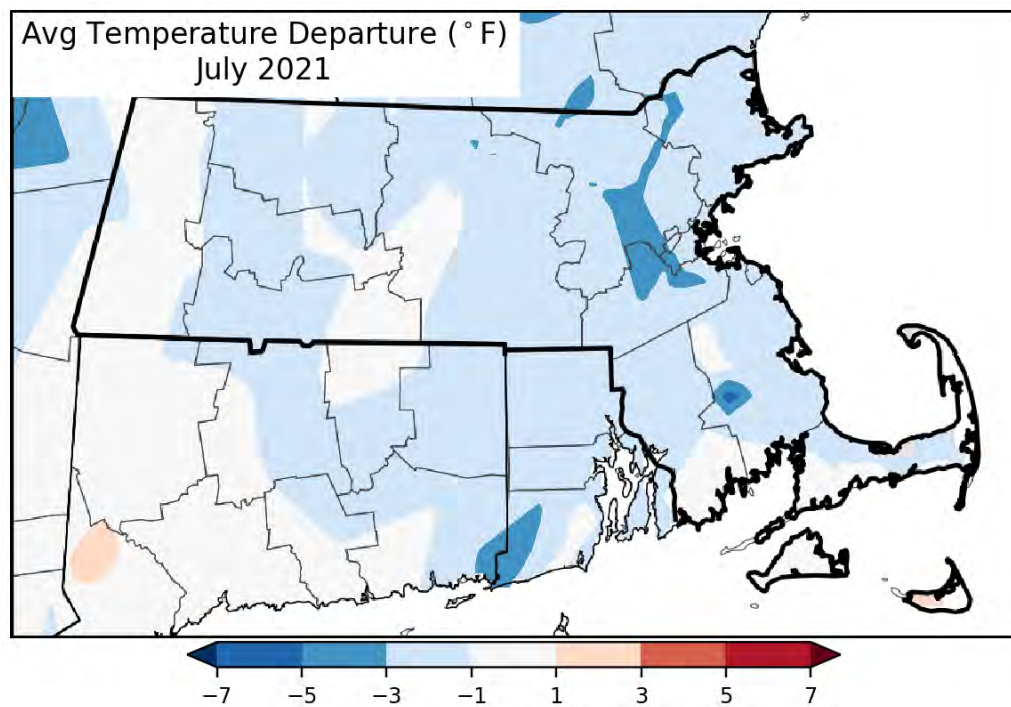
The Commonwealth of Massachusetts
Charles D. Baker, Governor

Kathleen A. Theoharides, Secretary, Executive Office of Energy and Environmental Affairs

JULY 2021 HYDROLOGIC CONDITIONS SUMMARY OF CONDITIONS

- Monthly average temperatures were near to below normal.
- Monthly regional precipitation was much above normal for all regions except the Cape Cod and the Islands regions, where it was normal. The July SPI Index Severity is at Level 0 for all regions.
- Monthly median streamflows were at or above the 97th percentile for all parts of the state except for the Cape Cod Region, which is at Index Severity Level 2. Throughout the month of July and across the state, there were incidents of urban and poor drainage flooding, stream flooding, and larger tributary and main-stem river flooding.
- Monthly median groundwater percentiles were above normal for all parts of the state except the Islands and Cape Cod regions. The Cape Cod Region is at Index Severity Level 1.
- Lakes & Impoundments levels were much above 30th percentile levels or at 100% capacity except for the monitored pond on Cape Cod, which is at the 11th percentile.
- NOAA's August outlook projects above-normal temperatures and equal chances for below-normal, normal, or above-normal precipitation.
- NOAA's 3-month outlook projects above-normal temperatures and above-normal precipitation.
- Appendices I and II provide additional precipitation data and information on the Massachusetts Drought Management Plan (DMP), respectively.

TEMPERATURE

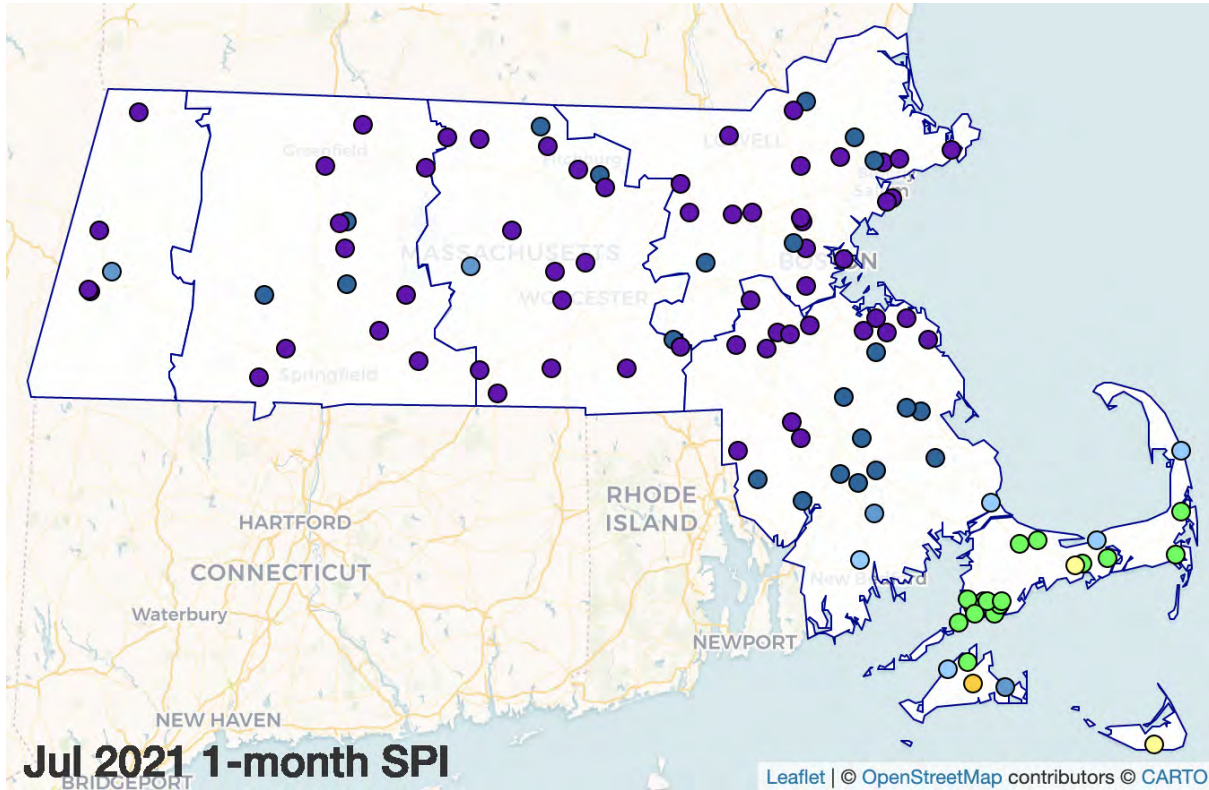


Monthly average temperatures were near to below normal.

<http://www.nrcc.cornell.edu/regional/monthly/monthly.html>

PRECIPITATION

For most of the state, July was a very rainy month. Precipitation was much above normal except for the Cape Cod and Islands regions where it was normal. According to the Boston/Norton National Weather Service (NWS) July E-5 Monthly Report of Hydrologic Conditions, using National Centers for Environmental Information data, it was the wettest July in the past 127 years, averaging 10.30 inches statewide. Some places received over one foot of rain, several months worth in just one month. Cape Cod and the Islands continue to have deficits for longer look-back periods. Appendix I provides additional details for precipitation data, including longer look-back periods.



● ≥ 0 to ≤ 2	● > 2 to ≤ 10	● > 10 to ≤ 20	● > 20 to ≤ 30	● > 30 to ≤ 70
● > 70 to ≤ 80	● > 80 to ≤ 90	● > 90 to ≤ 98	● > 98 to ≤ 100	

REGION	NUMBER OF SITES REPORTING	JULY MONTHLY AVERAGE (IN)	DEPARTURE FROM HISTORICAL (IN)	SPI* PERCENTILE 1-MONTH	SPI PERCENTILE 3-MONTH	SPI PERCENTILE 6-MONTH
WESTERN	5	11.09	6.69	99	97	92
CTRV	13	13.02	8.78	100	95	91
CENTRAL	18	11.52	7.54	100	97	90
NORTHEAST	23	11.68	8.13	99	97	91
SOUTHEAST	28	9.17	5.62	98	93	83
CAPE COD	18	2.65	-0.25	48	45	26
ISLANDS	5	2.86	0.16	70	45	32

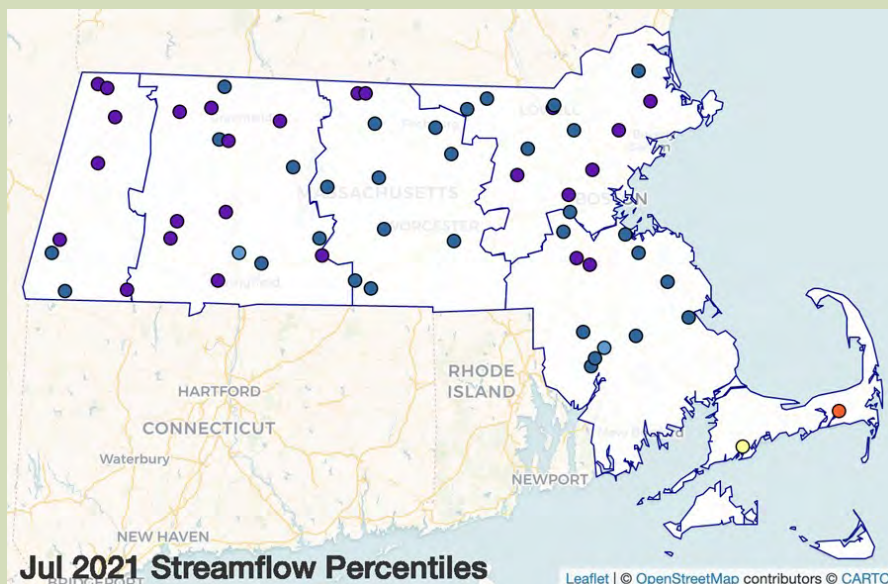
DMP Index Severity Levels			
1	2	3	4

*SPI is the Standardized Precipitation Index used in the Drought Management Plan (DMP) expressed here as a percentile and represents the variation, in standard deviations, from long-term precipitation averages.

STREAMFLOW

Excessive rain throughout the month of July kept regional monthly streamflow medians above the 97th percentile except for the Cape Cod region, which is at Index Severity Level 2. Following is a summary from the Norton/Boston NWS July E-5 report regarding flooding: Throughout July there was urban and poor drainage flooding, stream flooding, and larger tributary and mainstem river flooding. Thunderstorms July 1st into July 2nd brought localized heavy rainfall in the Boston, Worcester County, and Chicopee areas causing urban and poor drainage flooding. Showers containing moderate to heavy rainfall occurred July 3rd leading to urban flooding in the Boston area. Preceded by soaking showers and thunderstorms on July 7th and 8th, on July 9th the remnants of Tropical Storm Elsa brought additional rain causing urban and poor drainage flooding as well as stream and river flooding. From July 16th to 19th showers and thunderstorms caused urban and poor drainage flooding and river and stream flooding especially in the central and western parts of the state.

Median Monthly Streamflow Percentiles Compared to Historical Values



●	≥0 to ≤2	●	>2 to ≤10	●	>10 to ≤20	●	>20 to ≤30	●	>30 to ≤70
●	>70 to ≤80	●	>80 to ≤90	●	>90 to ≤98	●	>98 to ≤100		

REGION	TOTAL GAGES REPORTING FOR JUL	≥0 TO ≤2 PERCENTILE	>2 TO ≤10 PERCENTILE	>10 TO ≤20 PERCENTILE	>20 TO ≤30 PERCENTILE	>90 PERCENTILE	MEDIAN OF INDIVIDUAL GAGE PERCENTILES
WESTERN	8	0	0	0	0	8	99
CTRV	15	0	0	0	0	14	99
CENTRAL	11	0	0	0	0	11	98
NORTHEAST	13	0	0	0	0	13	98
SOUTHEAST	12	0	0	0	0	11	97
CAPE COD	2	0	1	0	1	0	13

Note: Not all gages report in all months due to ice, beaver dams or other

DMP Index Severity Levels			
1	2	3	4

Time Series of the Percent of Gages at Their Respective Percentile Flows for Average Daily Streamflows Compared to Historical Values

Streamflow is monitored by the Commonwealth of Massachusetts and United States Geological Survey cooperative stream gaging program.

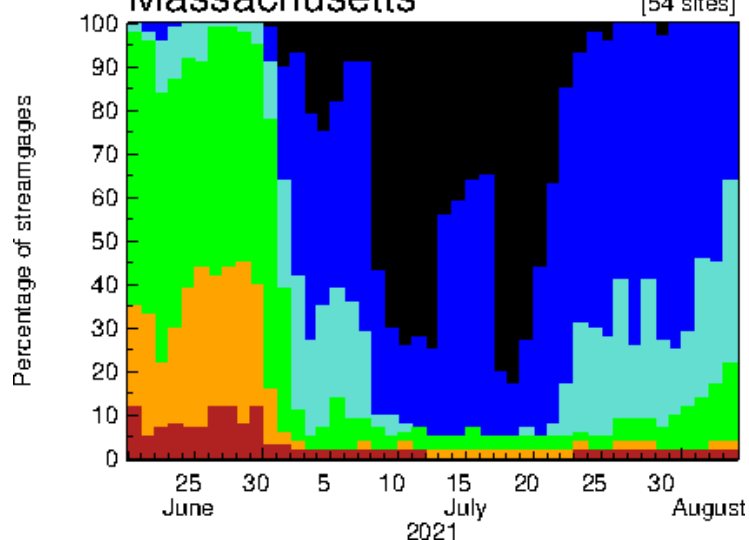
<https://waterdata.usgs.gov/nwis/sw>

Explanation - Percentile classes							
Low	<10	10-24	25-75	76-90	>90	High	No Data
	Much below normal	Below normal	Normal	Above normal	Much above normal		

Last 45 Days

Massachusetts

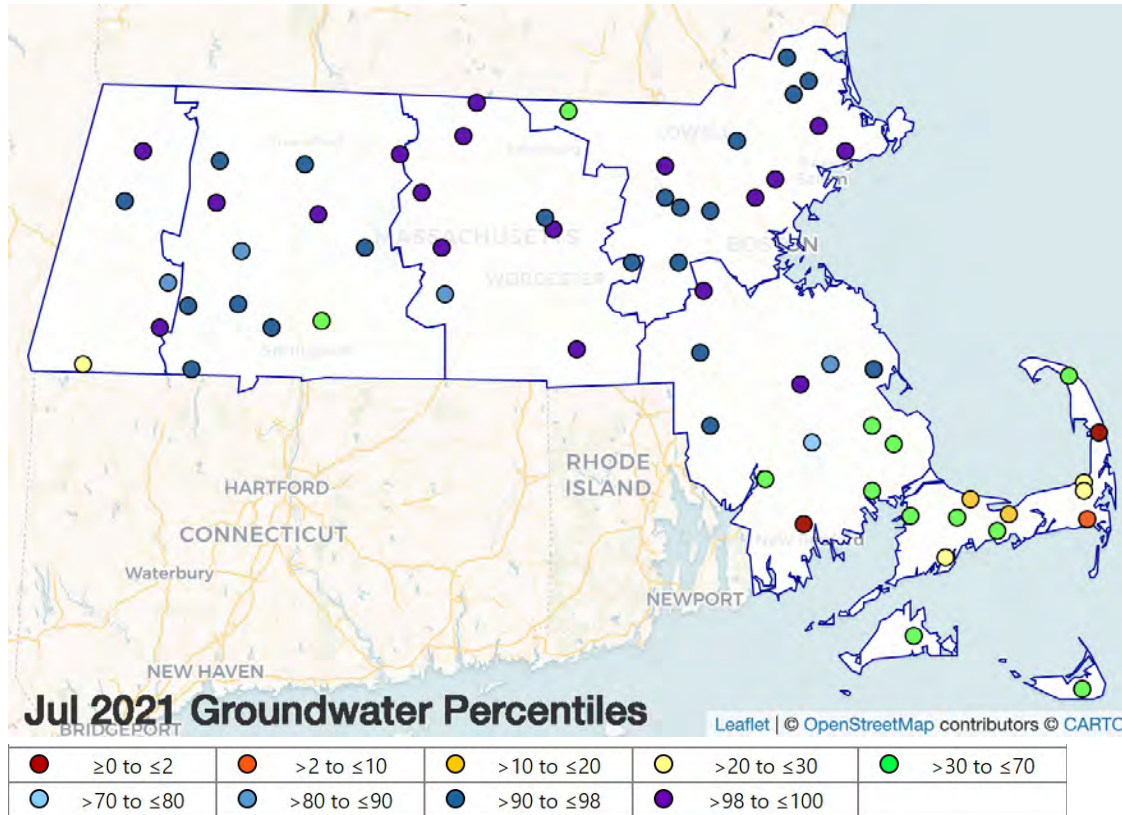
[54 sites]



GROUNDWATER

Groundwater percentiles of individual wells were mostly above 90th percentile throughout the state, except for parts of the Southeast, Cape Cod, and Islands regions. The median of individual well percentiles was above normal for all regions except the Islands, where it was normal, and Cape Cod, which showed only slight improvement and remains at Index Severity Level 1.

End of Month Groundwater Compared to Historical in the Climate Response Network



REGION	TOTAL WELLS REPORTING FOR JUL	≥ 0 TO ≤ 2 PERCENTILE	> 2 TO ≤ 10 PERCENTILE	> 10 TO ≤ 20 PERCENTILE	> 20 TO ≤ 30 PERCENTILE	> 90 PERCENTILE	MEDIAN OF INDIVIDUAL WELL PERCENTILES
WESTERN	5	0	0	0	1	3	98
CTRV	12	0	0	0	0	10	95
CENTRAL	9	0	0	0	0	8	100
NORTHEAST	14	0	0	0	0	13	98
SOUTHEAST	13	1	0	0	0	6	88
CAPE COD	11	1	1	2	3	0	26
ISLANDS	2	0	0	0	0	0	37

DMP Index Severity Levels			
1	2	3	4

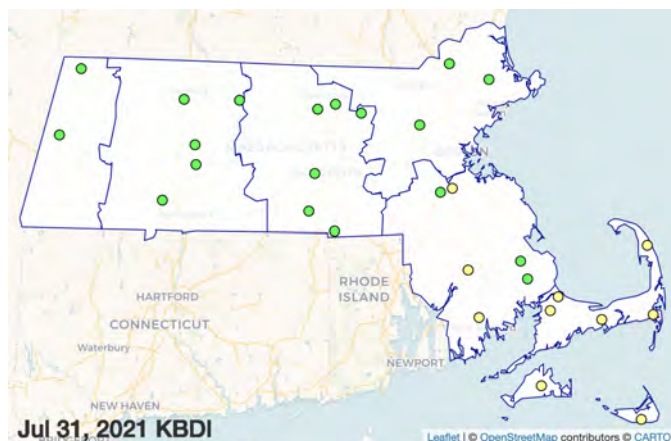
LAKES AND IMPOUNDMENTS

REGION	TOTAL REPORTING	MEDIAN OF INDIVIDUAL PERCENTILES OR PERCENT FULL
WESTERN	1	100% full
CTRV	2	93
CENTRAL	5	100% full; 94
NORTHEAST	4	95
SOUTHEAST	2	80
CAPE COD	1	11

DMP Index Severity Levels do not necessarily reflect water supply status.

At the end of July, most lake and impoundment levels were much greater than their 30th percentile values or at 100% full capacity. The monitored pond on Cape Cod remained at the 11th percentile.

DMP Index Severity Levels			
1	2	3	4



KEETCH BYRAM DROUGHT INDEX (KBDI)

Point Values - KBDI Range				
● ≥700 to ≤800	● ≥600 to <700	● ≥400 to <600	● ≥200 to <400	● ≥0 to <200

REGION	NUMBER OF SITES REPORTING	HIGHEST OF SITE VALUES
WESTERN	2	15
CTRV	5	114
CENTRAL	6	161
NORTHEAST	3	108
SOUTHEAST	6	268
CAPE COD	5	355
ISLANDS	2	340

DMP Index Severity Levels			
1	2	3	4

CROP MOISTURE INDEX (CMI)

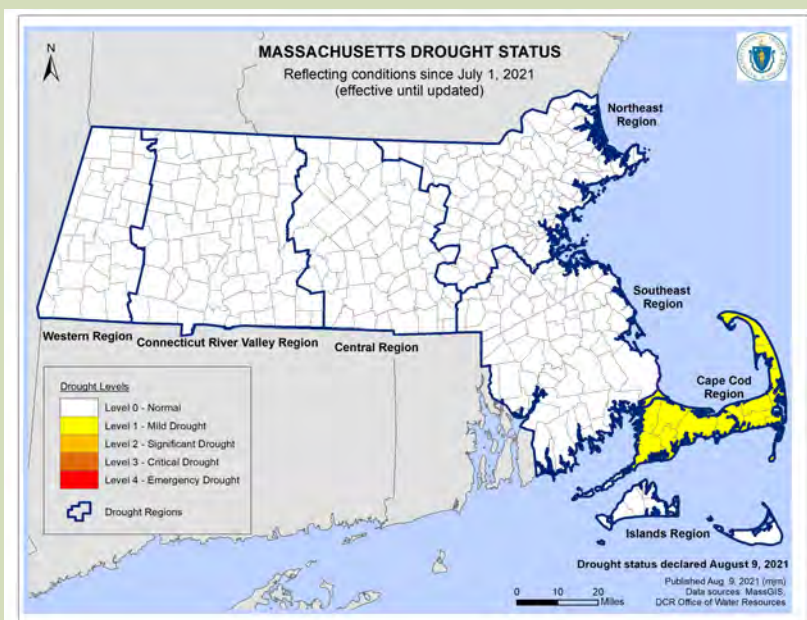
CMI weekly values for the period ending July 31st ranged from 0.34 (Slightly Dry/Favorably Moist) in the coastal area to 1.33 & 1.89 (Abnormally Moist) in the central and western areas respectively. All MA drought regions are at Index Severity Level 0.

[Climate Prediction Center - Monitoring & Data: Drought Monitoring \(noaa.gov\)](https://climatepredictioncenter.noaa.gov/monitoring-data/drought-monitoring/)

SNOWFALL

Snowfall is provided seasonally.

DROUGHT CONDITIONS AND FORECASTS



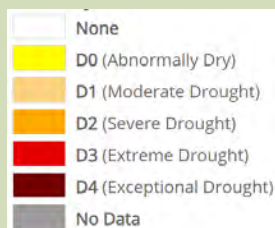
Massachusetts Drought Status

In effect from July 1, 2021 until updated, on August 9, 2021 Massachusetts Energy and Environmental Affairs (EEA) Secretary Kathleen Theoharides declared a Level 1-Mild Drought in the Cape Cod Region and Level 0-Normal Conditions in the Western, Connecticut River Valley, Central, Northeast, Southeast, and Islands Regions.

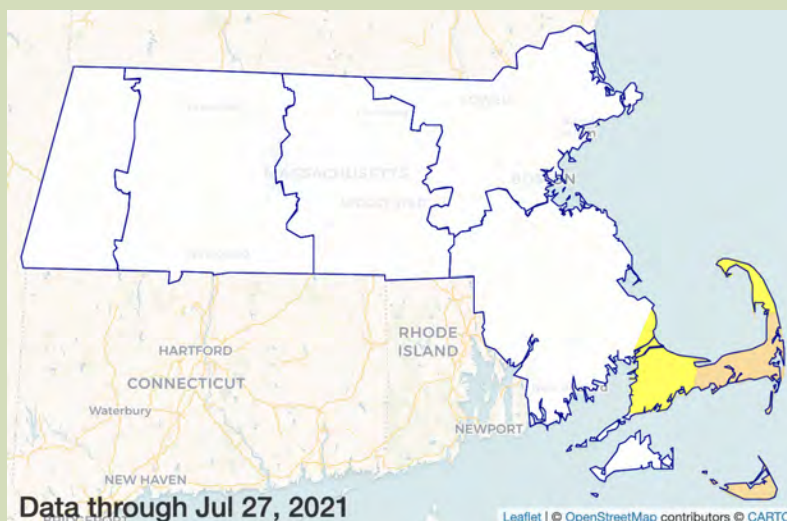
U.S. Drought Monitor (USDM)

At the end of July, the USDM showed areas of D0 in the upper and outer Cape, and areas of D1 in the mid to outer Cape and Nantucket.

USDM maps are produced by the National Drought Mitigation Center (NDMC). For methods, weekly updates, and past maps see: <https://droughtmonitor.unl.edu>



Data through July 25, 2021; map released Jul 27, 2021



NOAA Climate Prediction Center

Temperature and Precipitation Outlook

August: The outlook released 7/31 shows a 50-60% probability of above-normal temperatures and equal chances of below-normal, normal, or above-normal precipitation.

August through October: The outlook released 7/15 shows a 60-70% probability of above-normal temperatures, and a 33-40% probability of above-normal precipitation. <https://www.cpc.ncep.noaa.gov/>

Monthly and Seasonal Drought Outlook

The monthly outlook for August released on 7/31 shows no drought development in the state. The seasonal outlook released on 7/15 and valid through October shows no drought development in the state and “drought removal likely” for the area of D1 on the mid to outer Cape.

This report was prepared by the Massachusetts Department of Conservation and Recreation. Data may be preliminary. Additional information, previous reports, and drought management information can be found at: <https://www.mass.gov/water-data-tracking>

DCR Precipitation Reports are available at <https://www.mass.gov/service-details/precipitation-composite-estimates-1> and <https://www.mass.gov/service-details/standardized-precipitation-index-spi-0>

APPENDIX I – ADDITIONAL PRECIPITATION DATA

Standardized Precipitation Index July 2021 (expressed as percentiles)

REGION	NUMBER OF SITES	1-mo*	2-mo	3-mo	6-mo	9-mo	12-mo	24-mo	36-mo*
WESTERN	5	99	96	97	92	86	74	54	78
CTRV	13	100	95	95	91	88	82	61	89
CENTRAL	18	100	95	97	90	90	80	72	93
NORTHEAST	23	99	95	97	91	91	81	70	87
SOUTHEAST	28	98	91	93	83	81	68	55	89
CAPE COD	18	48	29	45	26	24	5	11	47
ISLANDS	5	70	30	45	32	27	12	38	77

DMP Index Severity Levels			
1	2	3	4

Percent of Average Historical Precipitation July 2021

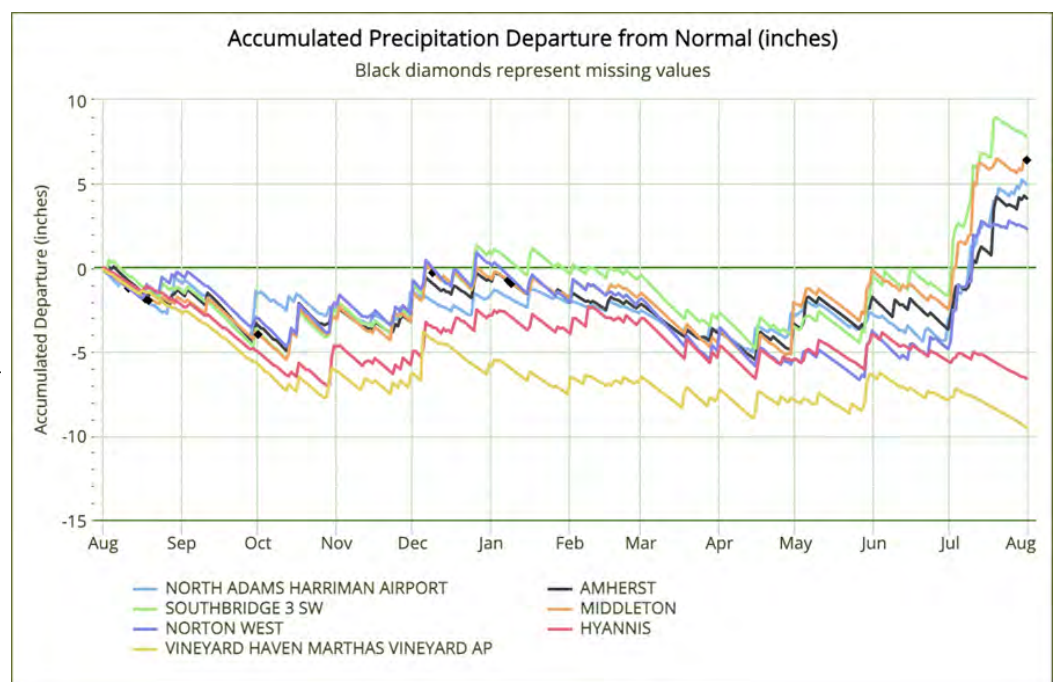
REGION	NUMBER OF SITES	HISTORICAL AVERAGE	JULY AVERAGE (IN)	DEPARTURE FROM HISTORICAL AVERAGE (IN)	PERCENT OF NORMAL
WESTERN	5	4.40	11.09	6.69	252%
CTRV	13	4.24	13.02	8.78	307%
CENTRAL	18	3.98	11.52	7.54	289%
NORTHEAST	23	3.55	11.68	8.13	329%
SOUTHEAST	28	3.55	9.17	5.62	258%
CAPE COD	18	2.90	2.65	-0.25	91%
ISLANDS	5	2.70	2.86	0.16	106%

Accumulated Precipitation

Departure shows the previous 12 months (August 2020 — July 2021).

Graph does not consider starting condition's wetness/dryness; does not show summer heat waves with high evapotranspiration; only one station per Drought Region is shown.

<https://xmacis.rcc-acis.org/>



APPENDIX II – DROUGHT MANAGEMENT PLAN INFORMATION

The Massachusetts Drought Management Plan (DMP) can be found at <https://www.mass.gov/doc/massachusetts-drought-management-plan/download>. The document provides details on the Drought Indices, how Drought Levels are determined, and actions associated with each drought level.

Drought Levels (Section 3.1 of the DMP)

- Level 0** Normal
- Level 1** Mild Drought
- Level 2** Significant Drought
- Level 3** Critical Drought
- Level 4** Emergency Drought

Index Severity Levels (Section 3.4 of the DMP)

SEVERITY LEVEL	STANDARDIZED PRECIPITATION INDEX (SPI)	STREAMFLOW	LAKES AND IMPOUNDMENTS	GROUNDWATER	KEETCH-BRYAM DROUGHT INDEX (KBDI)	CROP MOISTURE INDEX
0	> 30th percentile				< 200	> -1.0
1	≤ 30 and > 20				200-400	≤ -1.0 and > -2.0
2	≤ 20 and > 10				400-600	≤ -2.0 and > -3.0
3	≤ 10 and > 2				600-700	≤ -3.0 and > -4.0
4	≤ 2				700-800	≤ -4.0

