

MASSACHUSETTS WATER RESOURCES COMMISSION

HYDROLOGIC CONDITIONS IN MASSACHUSETTS

MAY
2023

The Commonwealth of Massachusetts

Maura T. Healey, Governor

*Rebecca L. Tepper, Secretary
Executive Office of Energy and Environmental Affairs*



MAY 2023 HYDROLOGIC CONDITIONS

SUMMARY OF CONDITIONS



- Monthly average temperatures were below normal to normal except for the outer Cape and Islands where it was above normal.



- Precipitation was variable by site but overall normal in the Regions except for the Western Region, which is at Index Severity Level (ISL) 2 for May.



- Crop Moisture Index showed normal conditions, but evaporative demand was elevated according to the Evaporative Demand Drought Index.



- The Keetch-Byram Drought Index showed normal soil moisture conditions at the end of the month.
- Streamflow was below normal to normal. The Western Region is at ISL 1, and the Cape Cod Region is at ISL 2.
- Groundwater was below normal to above normal. Regional medians of individual well percentiles were in the normal range.



- Lake and impoundment levels were mostly above their 30th percentile and/or were 100% full. The monitored pond in the Cape Cod Region is at ISL 2.



- NOAA's June outlook shows equal chances for below-normal, normal, or above-normal temperatures for the eastern part of the state, chances leaning for above-normal temperatures for the rest of the state, and equal chances for below-normal, normal, or above-normal precipitation for the entire state.



- NOAA's 3-month outlook shows chances likely for above-normal temperatures and equal chances for below-normal, normal, or above-normal precipitation.



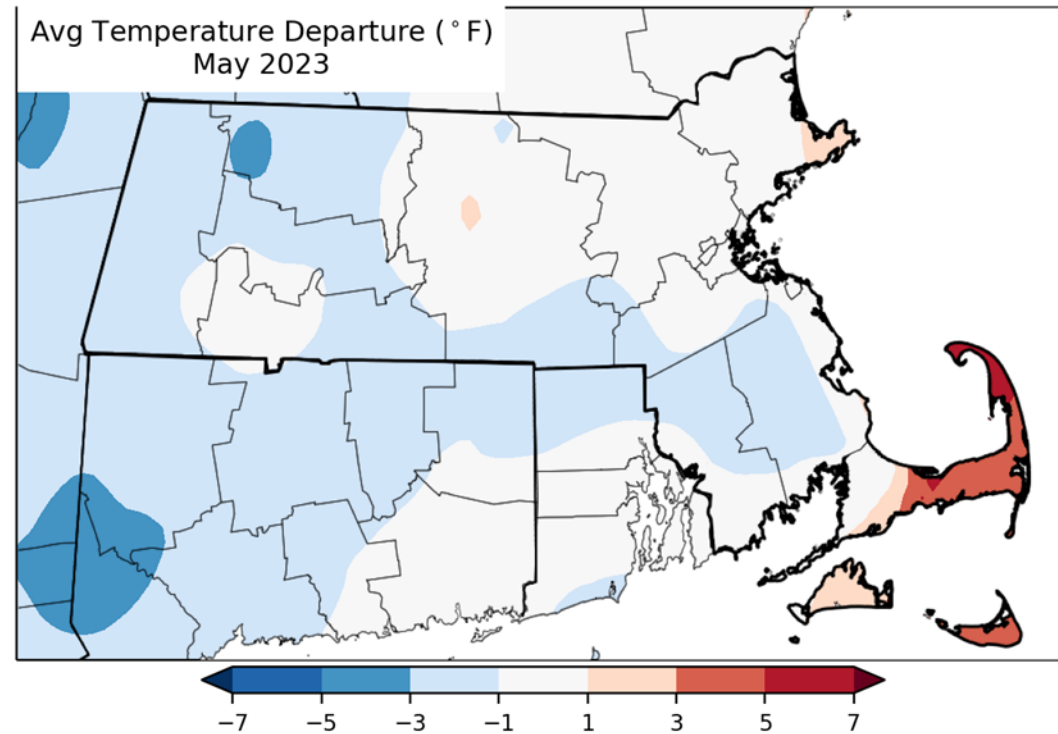
- Appendix II provides information on the Massachusetts Drought Management Plan (DMP) including ISL thresholds used in this report.

This report was prepared by the Massachusetts Department of Conservation and Recreation. Data may be preliminary. Analysis reflects automated calculations done 06/07/2023. Additional information, previous reports, and the Massachusetts Drought Dashboard with weekly updates to the drought indices can be found at: <https://www.mass.gov/drought-monitoring>

Monthly average temperatures were below normal to normal except for the Mid to Outer Cape and the Islands where it was above normal. According to the Northeast Regional Climate Center, the Worcester climate site had its 9th warmest spring (March-May) and the Boston climate site has its 11th warmest.

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

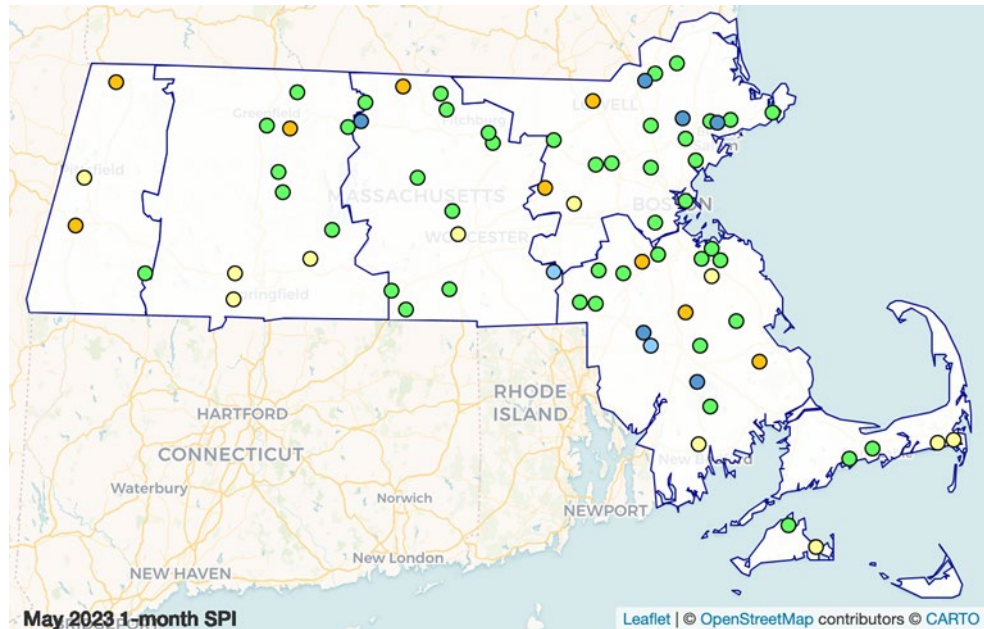
AVERAGE TEMPERATURE DEPARTURE





STANDARDIZED PRECIPITATION INDEX (SPI) AS A PERCENTILE

May precipitation was below normal to above normal at individual sites. The Western Region is at an elevated ISL for May as well for the 2-month look-back period. The Cape Cod and Islands Regions are at elevated ISLs for the 2- and 3-month look-back periods. In addition to the table below, Appendix I provides all 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	MAY MONTHLY AVERAGE (IN)	DEPARTURE FROM HISTORICAL (IN)	SPI PERCENTILE 1-MONTH	SPI PERCENTILE 3-MONTH	SPI PERCENTILE 6-MONTH
WESTERN	4	2.45	-1.46	16	38	58
CTRV	10	3.03	-0.75	40	56	75
CENTRAL	14	3.46	-0.28	50	55	82
NORTHEAST	20	3.22	-0.23	45	58	76
SOUTHEAST	19	3.42	-0.15	51	46	65
CAPE COD	4	2.56	-1.02	31	25	81
ISLANDS	2	2.84	-0.90	37	20	56

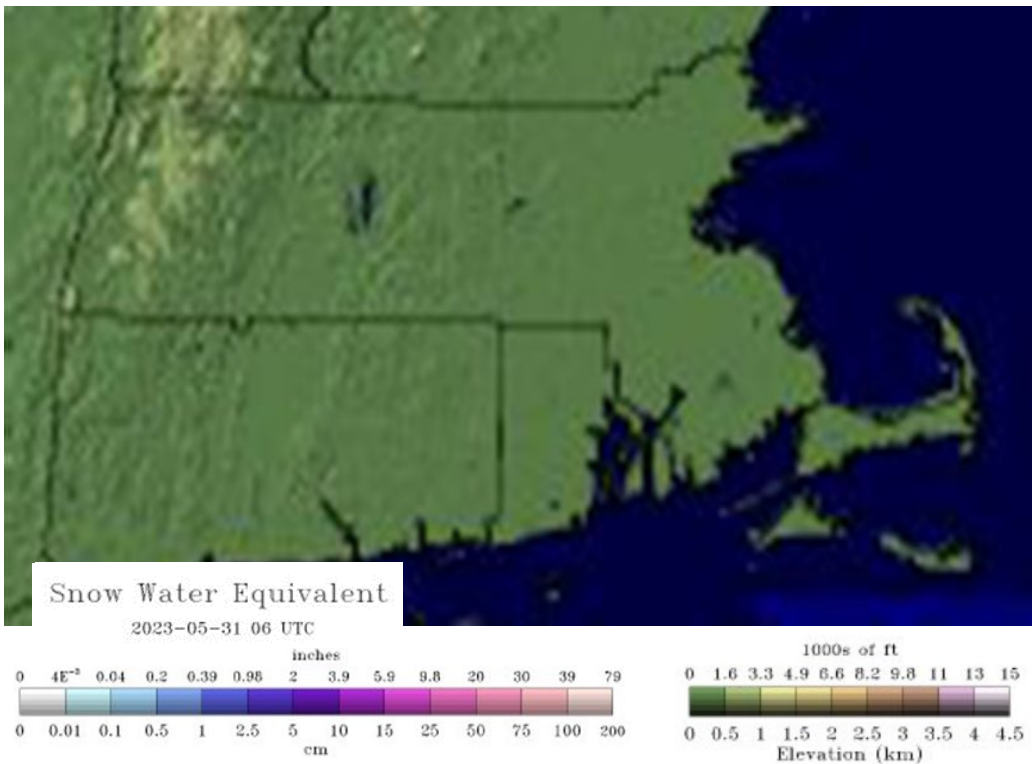
SPI is the Standardized Precipitation Index used in the Drought Management Plan (DMP) expressed here as a percentile and represents the variation from long-term precipitation.

DMP Index Severity Levels			
1	2	3	4

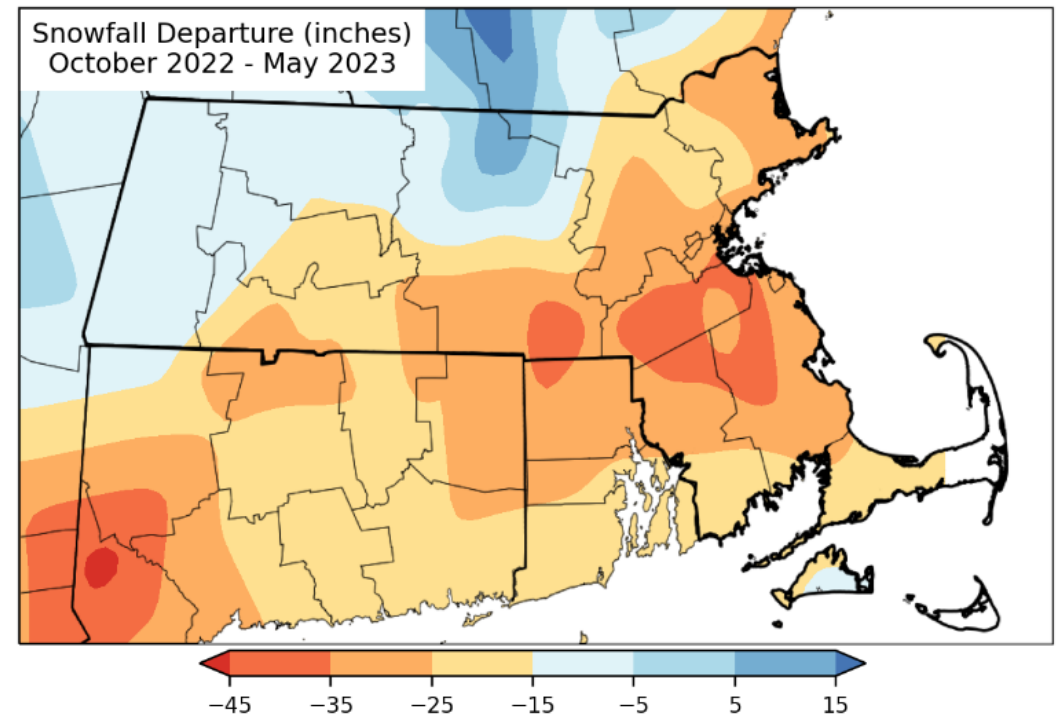
SNOW COVER

At the end of May, there was no snow cover remaining in Massachusetts. Snowfall was below average for the season except in northern central part of the state. The Boston climate site had its fourth least snowy snowfall season (Oct. 1- May 31).

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



SEASON-TO-DATE SNOWFALL DEPARTURE



CROP MOISTURE INDEX (CMI) - 2019 DROUGHT MANAGEMENT PLAN

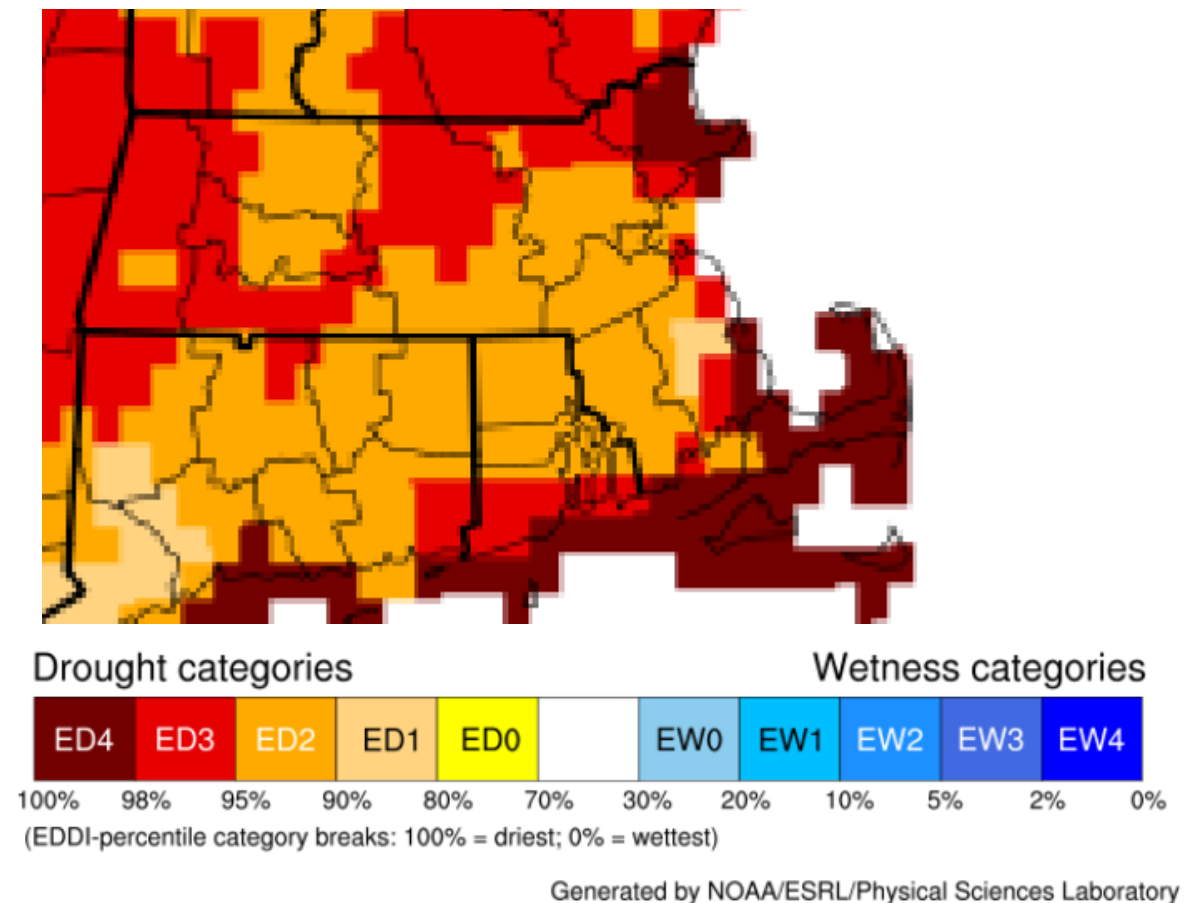
Weekly values for the period ending May 27, 2023 from NOAA's National Weather Service Climate Prediction Center were: 0.60 in the western part, 0.80 in the central part, and 0.77 in the coast part of the state, all of which are in the slightly dry/favorably moist/normal range.

https://www.cpc.ncep.noaa.gov/products/monitoring_and_data/drought.shtml



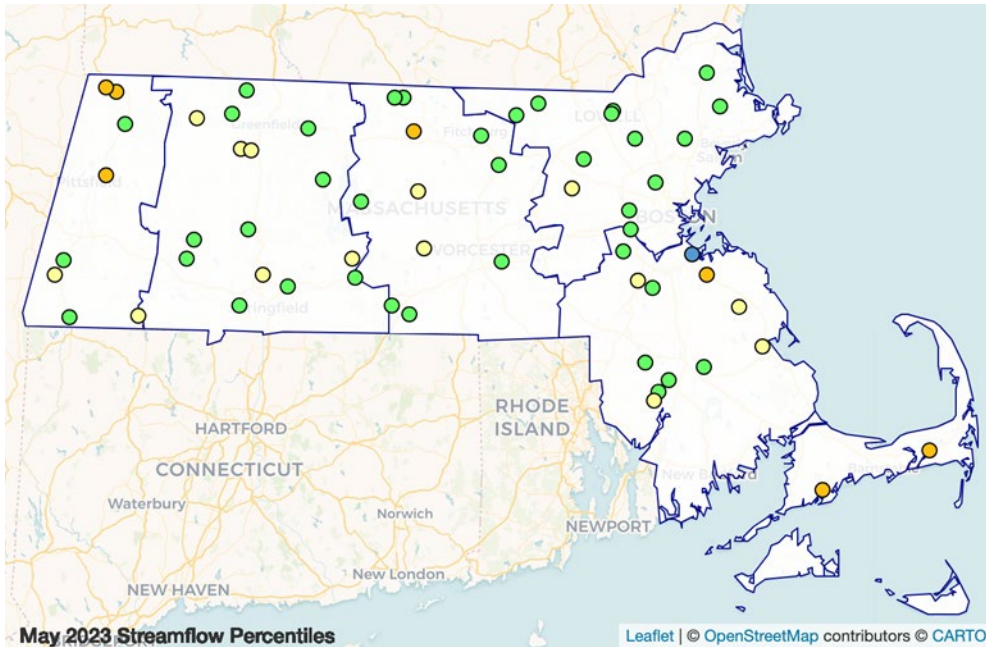
EVAPORATIVE DEMAND DROUGHT INDEX (EDDI) - PROPOSED FOR THE DROUGHT MANAGEMENT PLAN

The 1-mos EDDI categories for May 31, 2023 were at elevated levels across the state.



During May, percentiles of individual streamflow gages varied across the state from below normal to normal with one gage above normal. The Western Region is at ISL 1, and the Cape Cod Region is at ISL 2.

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	NUMBER OF GAGES REPORTING	≥ 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	3	2	0	26
CTRV	15	0	0	0	5	0	33
CENTRAL	11	0	0	1	2	0	36
NORTHEAST	13	0	0	0	1	0	45
SOUTHEAST	12	0	0	1	4	0	35
CAPE COD	2	0	0	2	0	0	15

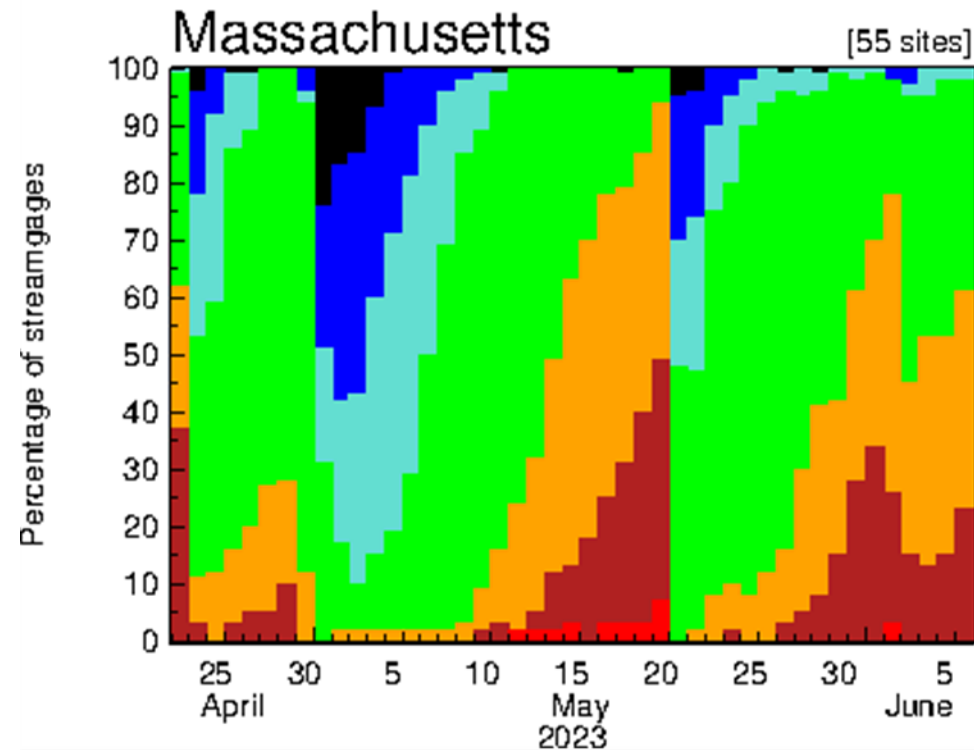
Note: Not all gages report in all months due to ice, beaver dams or other conditions. Streamflow index is not applicable to the Islands.

DMP Index Severity Levels			
1	2	3	4

USGS TIME SERIES OF THE PERCENT OF GAGES AT THEIR RESPECTIVE PERCENTILE FLOWS FOR AVERAGE DAILY STREAMFLOWS COMPARED TO HISTORICAL VALUES

<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		



According to the May NWS E-5 Monthly Report of Hydrologic Conditions for the Boston/Norton service area, no flooding was reported in the Boston/Norton service area within Massachusetts.

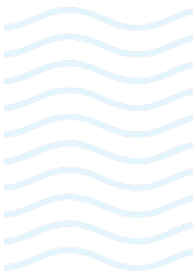
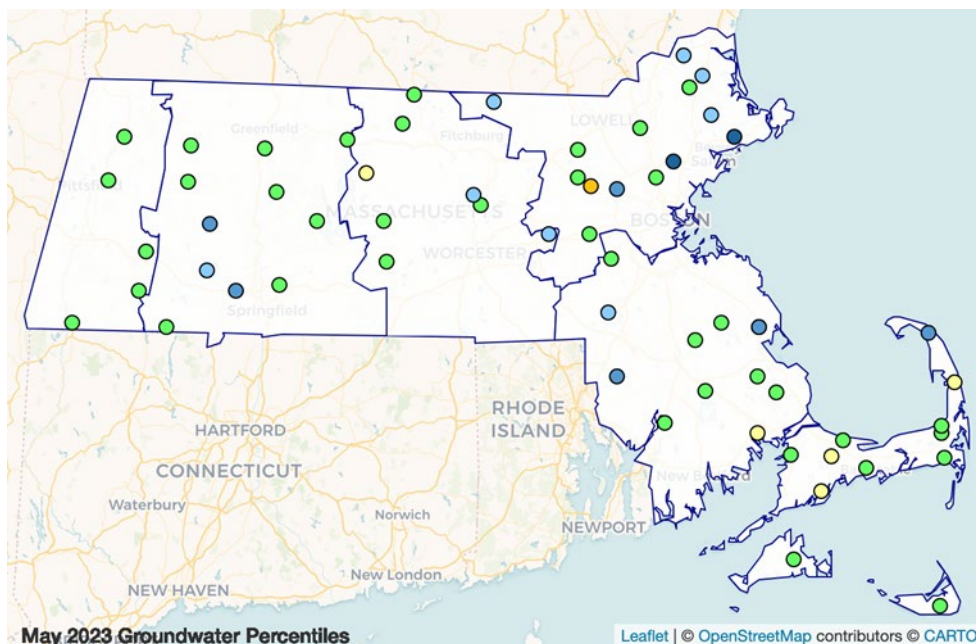


Image: Courtesy of NASA/JPL-Caltech



May groundwater levels ranged from below normal to above normal. Regional medians of individual well percentiles were in the normal range.

END OF MONTH GROUNDWATER COMPARED TO HISTORICAL IN THE CLIMATE RESPONSE NETWORK WELLS



● ≥ 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 WELLS REPORTING	≥ 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	0	0	44
CTRV	11	0	0	0	0	0	61
CENTRAL	8	0	0	0	1	0	50
NORTHEAST	14	0	0	1	0	2	70
SOUTHEAST	12	0	0	0	1	0	54
CAPE COD	10	0	0	0	3	0	43
ISLANDS	2	0	0	0	0	0	34

DMP Index Severity Levels			
1	2	3	4

At the end of May, most lake and impoundment levels were above their 30th percentile and/or were 100% full. The monitored pond in the Cape Cod Region is at ISL2.

REGION	NUMBER OF SITES REPORTING	MEDIAN OF INDIVIDUAL PERCENTILES OR PERCENT FULL
WESTERN	2	100%
CTRV	2	70th
CENTRAL	3	64th
NORTHEAST	4	35th
SOUTHEAST	2	52nd
CAPE COD	1	16th

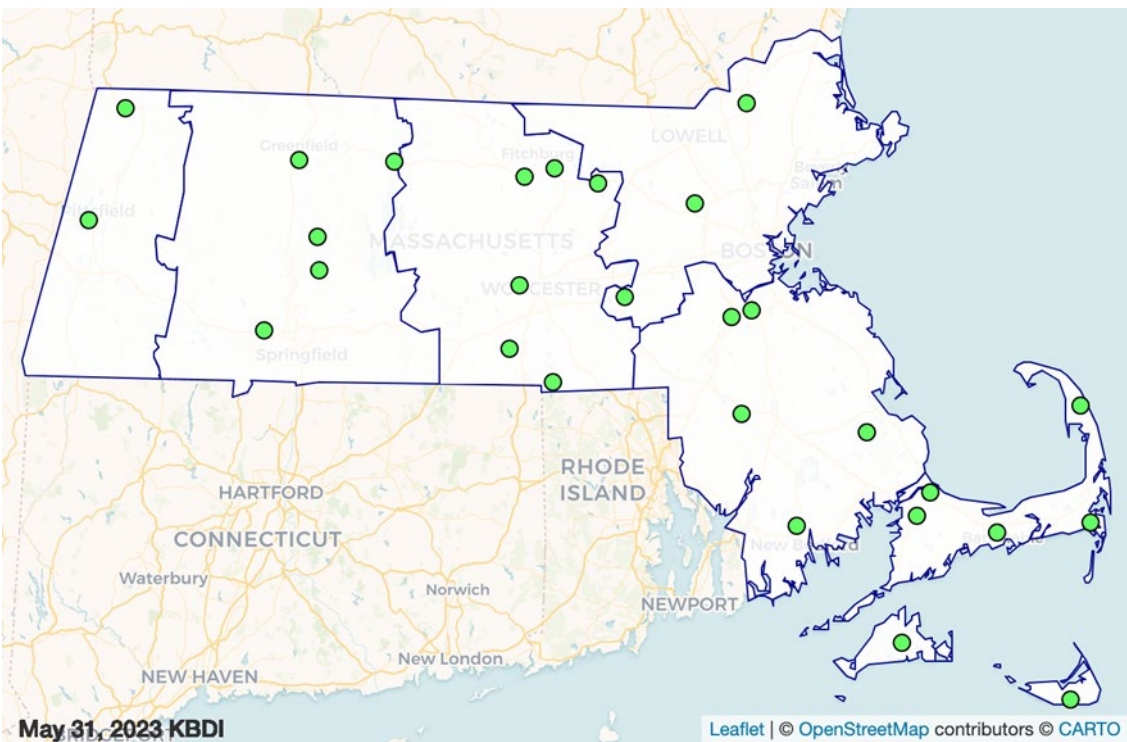
DMP Index Severity Levels do not necessarily reflect water supply status.

DMP Index Severity Levels			
1	2	3	4










At the end of May, Keetch Byram Drought Index (KBDI) values were in the normal range.



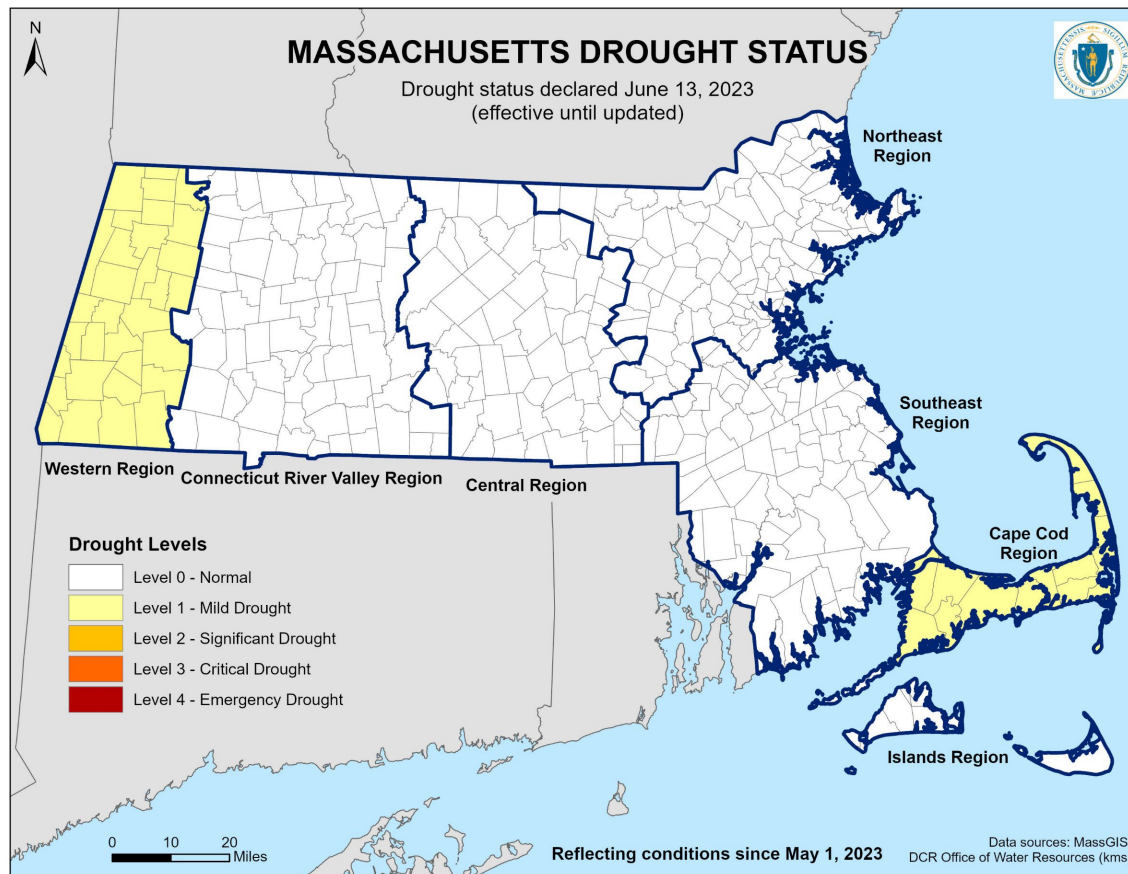
REGION	NUMBER OF SITES REPORTING	HIGHEST OF SITE VALUES
WESTERN	2	137
CTRV	5	109
CENTRAL	6	171
NORTHEAST	3	95
SOUTHEAST	5	112
CAPE COD	5	104
ISLANDS	2	66

DMP Index Severity Levels			
1	2	3	4

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

MASSACHUSETTS DROUGHT STATUS

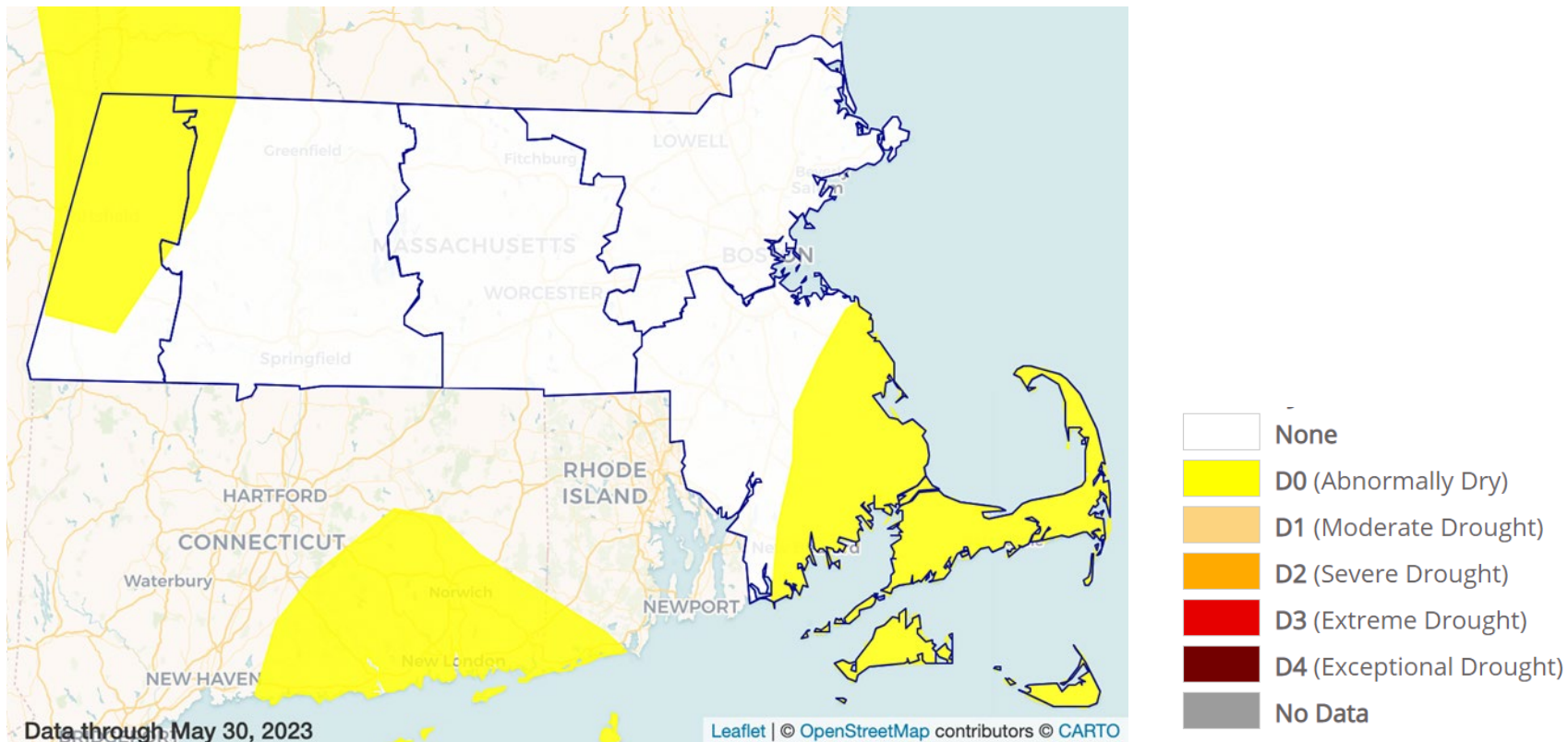
On June 13, 2023, Massachusetts Energy and Environmental Affairs (EEA) Secretary Rebecca L. Tepper declared that starting from May 1, 2023, the Western and Cape Cod Regions are at Level 1 Mild Drought Conditions. The Connecticut River Valley, Central, Northeast, Southeast, and Islands Region are at Level 0 Normal Conditions. This status remains in effect until further updated.



U.S. DROUGHT MONITOR (USD M)

At the end of May, the USD M showed areas of D0 (Abnormally Dry) in parts of western and southeastern MA as well as the Cape and Islands.

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

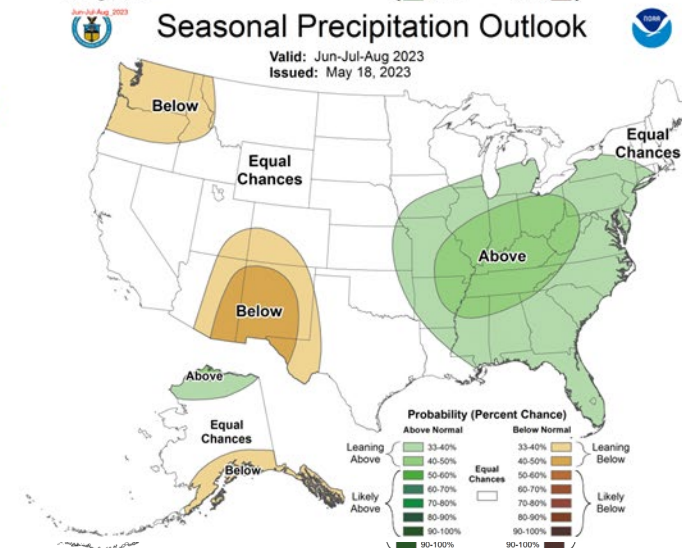
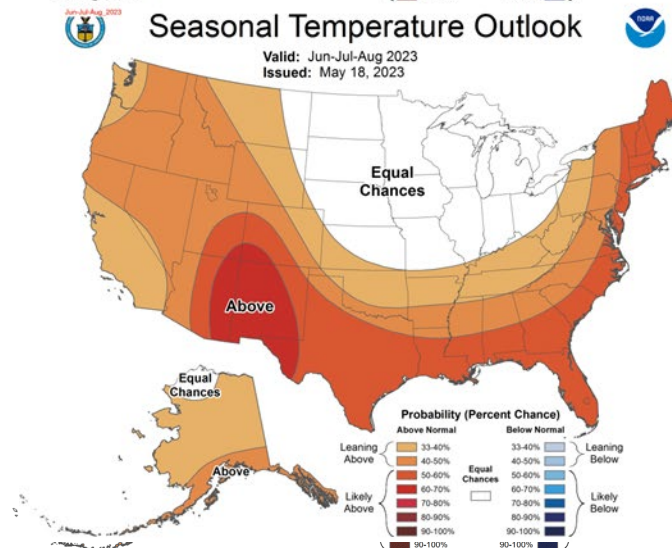
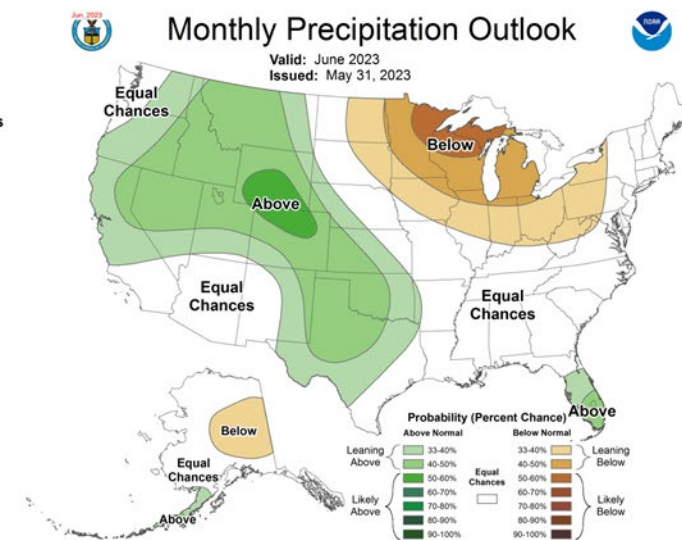
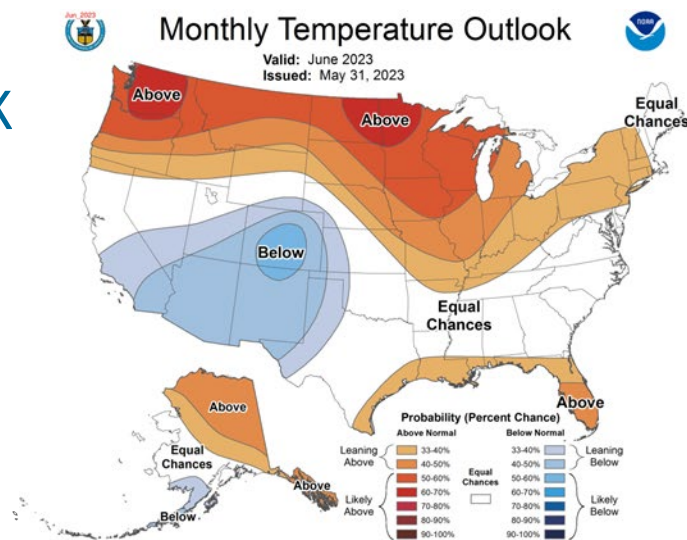


TEMPERATURE AND PRECIPITATION OUTLOOK

June: The outlook issued 5/31 shows equal chances for above-normal, normal, or below-normal temperatures for the eastern part of the state, a 33-40% chance of above-normal temperatures for the rest of the state, and equal chances for above-normal, normal, or below-normal precipitation for the entire state.

June through August: The seasonal outlook issued 5/18 shows a 50-60% chance of above-normal temperatures and equal chances for above-normal, normal, or below-normal precipitation.

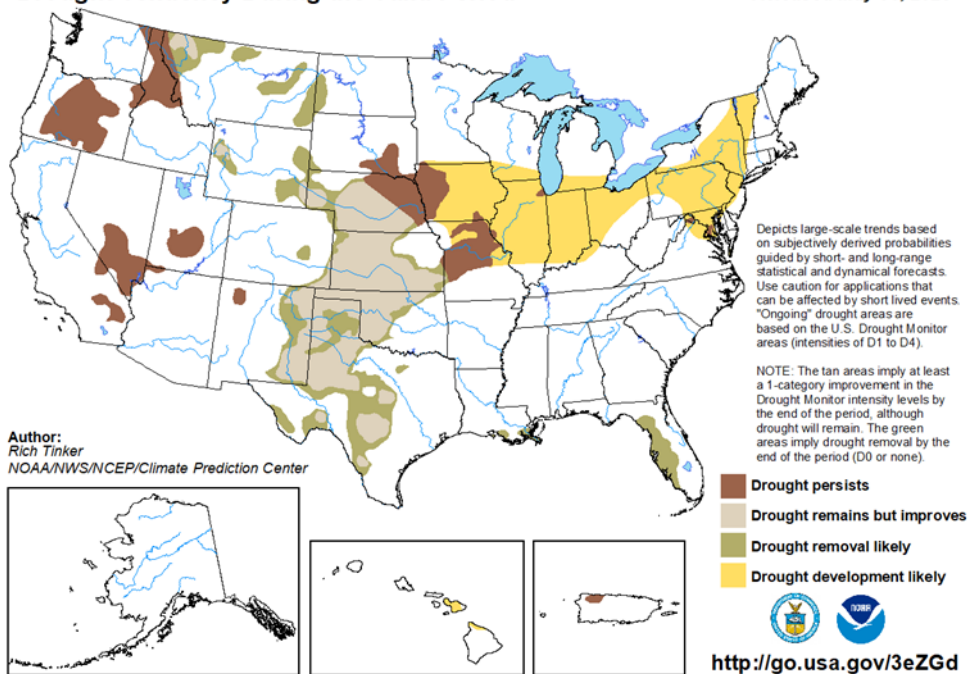
<https://www.cpc.ncep.noaa.gov/>



U.S. Monthly Drought Outlook

Drought Tendency During the Valid Period

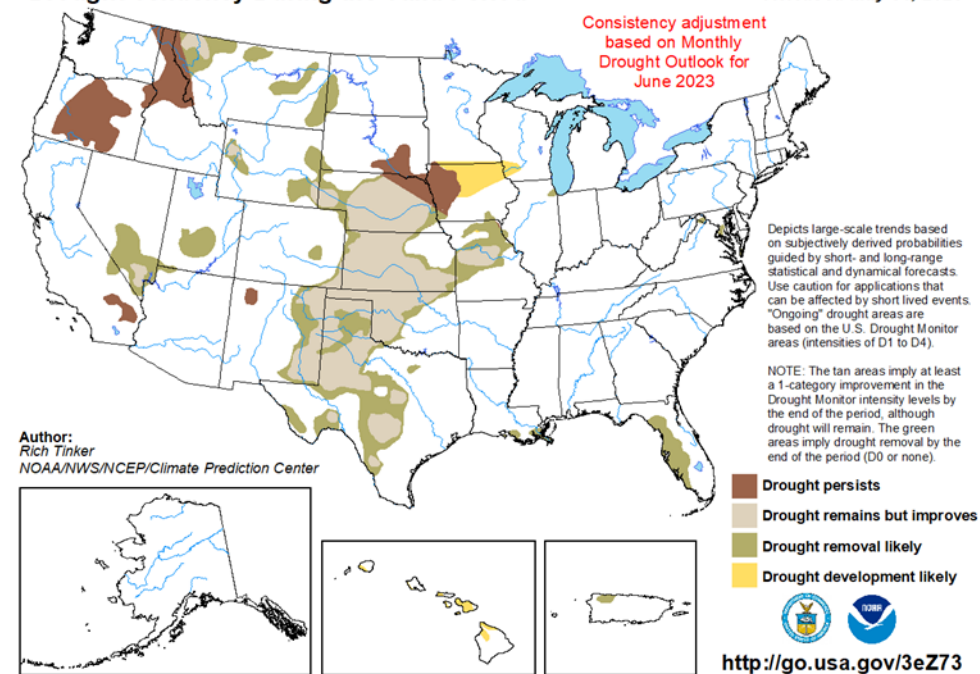
Valid for June 2023
Released May 31, 2023



U.S. Seasonal Drought Outlook

Drought Tendency During the Valid Period

Valid for June 1 - August 31, 2023
Released May 31, 2023



MONTHLY AND SEASONAL DROUGHT OUTLOOK

The monthly outlook for June released on 5/31 shows no drought development in Massachusetts except for a western portion of Berkshire County.

The seasonal outlook for June through August issued on 5/31 shows no drought development in Massachusetts.

<http://www.cpc.ncep.noaa.gov/products/Drought>

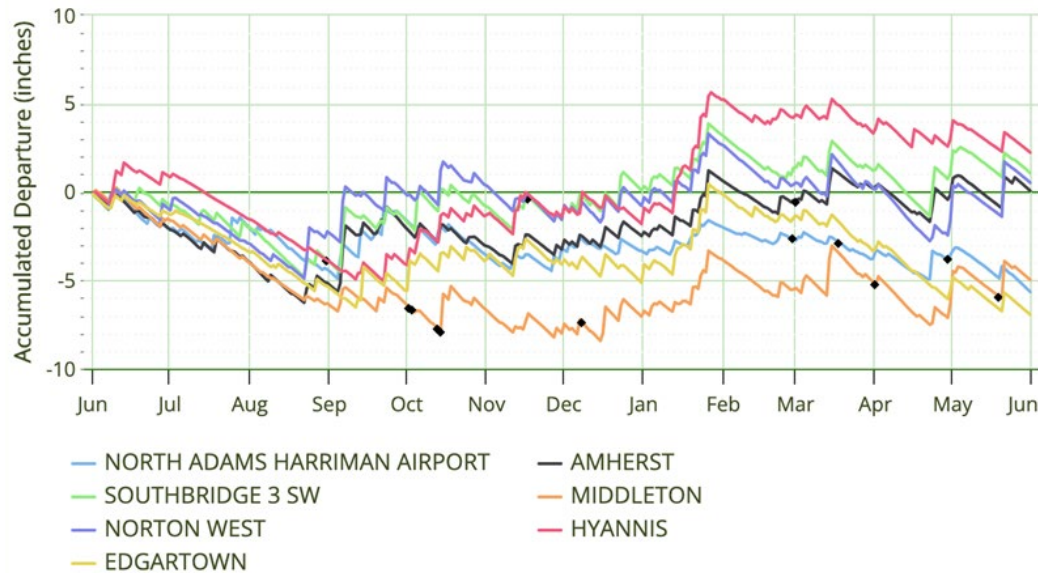
ADDITIONAL PRECIPITATION DATA

Standardized Precipitation Index— May 2023 as percentiles

REGION	NUMBER OF SITES	1-mo	2-mo	3-mo	6-mo	9-mo	12-mo	24-mo	36-mo
WESTERN	4	16	26	38	58	74	43	83	70
CTRV	10	40	49	56	75	78	51	76	69
CENTRAL	14	50	46	55	82	85	61	87	77
NORTHEAST	20	45	47	58	76	60	32	67	73
SOUTHEAST	19	51	34	46	65	68	55	71	61
CAPE COD	4	31	27	25	81	85	69	73	27
ISLANDS	2	37	21	20	56	61	44	22	10

Accumulated Precipitation Departure from Normal (inches)

Black diamonds represent missing values



DMP Index Severity Levels

1	2	3	4
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Accumulated Precipitation Departure from 30-Year Normals in Inches

Graph does not consider starting condition's wetness/dryness; does not show summer heat waves with high evapotranspiration; and shows only one station per Drought Region. <https://xmacis.rcc-acis.org/>

ADDITIONAL PRECIPITATION DATA (CONT.)

Percent of Average Historical Precipitation—May 2023

REGION	NUMBER OF SITES REPORTING	HISTORICAL AVERAGE	MAY AVERAGE (IN)	DEPARTURE FROM HISTORICAL AVERAGE (IN)	PERCENT OF NORMAL
WESTERN	4	3.91	2.45	-1.46	63%
CTRV	10	3.78	3.03	-0.75	80%
CENTRAL	14	3.74	3.46	-0.28	93%
NORTHEAST	20	3.45	3.22	-0.23	93%
SOUTHEAST	19	3.57	3.42	-0.15	96%
CAPE COD	4	3.58	2.56	-1.02	72%
ISLANDS	2	3.74	2.84	-0.90	76%



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.

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

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



Massachusetts Water Resources Commission

Executive Office of Energy and Environmental Affairs

www.mass.gov/conservemawater

www.mass.gov/drought-management