

MASSACHUSETTS WATER RESOURCES COMMISSION



HYDROLOGIC CONDITIONS IN MASSACHUSETTS

APRIL
2023

The Commonwealth of Massachusetts

Maura T. Healey, Governor

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



APRIL 2023 HYDROLOGIC CONDITIONS

SUMMARY OF CONDITIONS



- Monthly average temperatures were above normal.
- Precipitation in April was overall normal in the Regions except for the Islands Region, which is at Index Severity Level (ISL) 1.



- Snow cover wasn't present at the end of the month. Season-to-date snowfall is below normal except for the northern central part of the state.



- Crop Moisture Index showed normal to moist 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 Central Region is at ISL 1, the Northeast Region is at ISL 2, and the Southeast Region is at ISL 3.



- Groundwater was below normal to above normal with the Central Region at ISL 1.



- 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 May outlook shows chances leaning for above normal temperatures and equal chances for below-normal, normal, or above-normal precipitation.



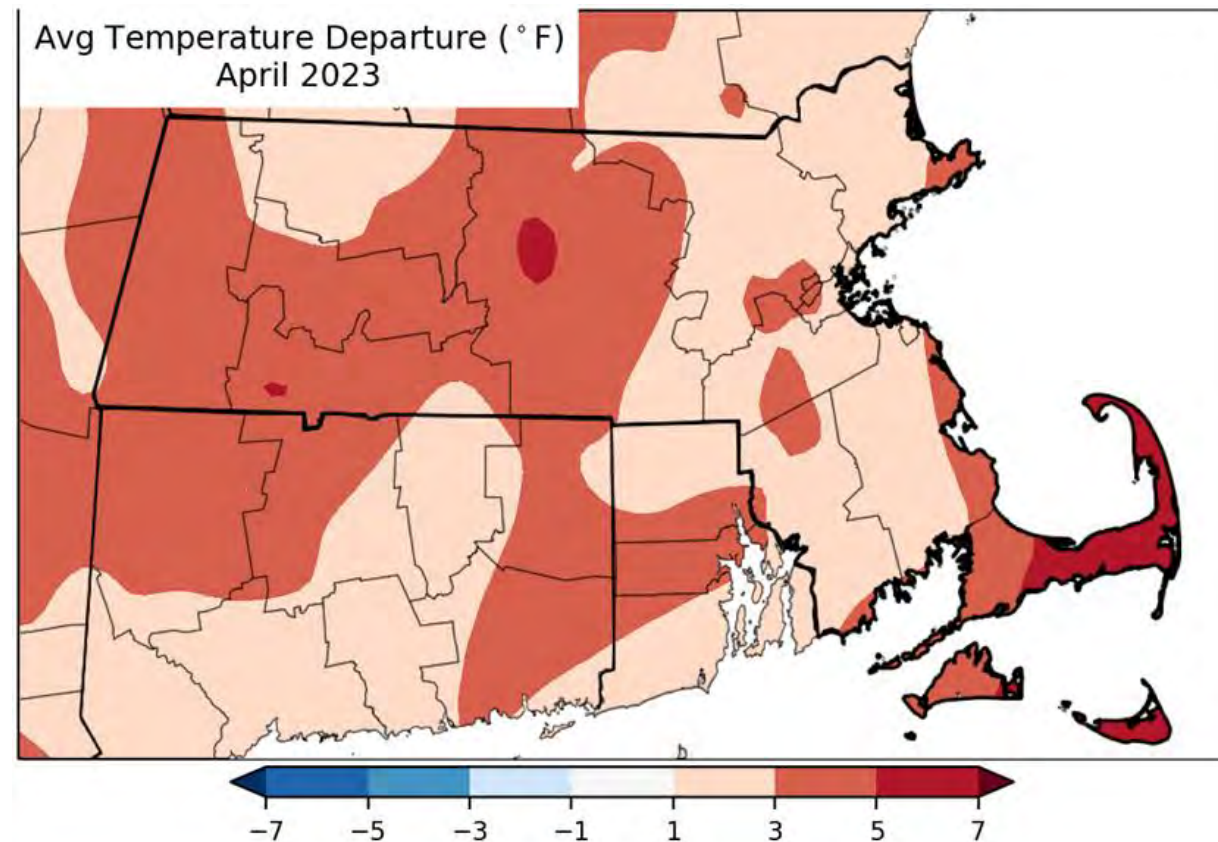
- NOAA's 3-month outlook shows chances likely for above-normal temperatures and equal chances for below-normal, normal, or above-normal precipitation.
- Appendix II provides information on the Massachusetts Drought Management Plan (DMP) including ISL thresholds used in this report.

This report was prepared by the Massachusetts Department of Conservation and Recreation. Data may be preliminary. Analysis reflects automated calculations done 05/09/2023. 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 generally above normal across the state.

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

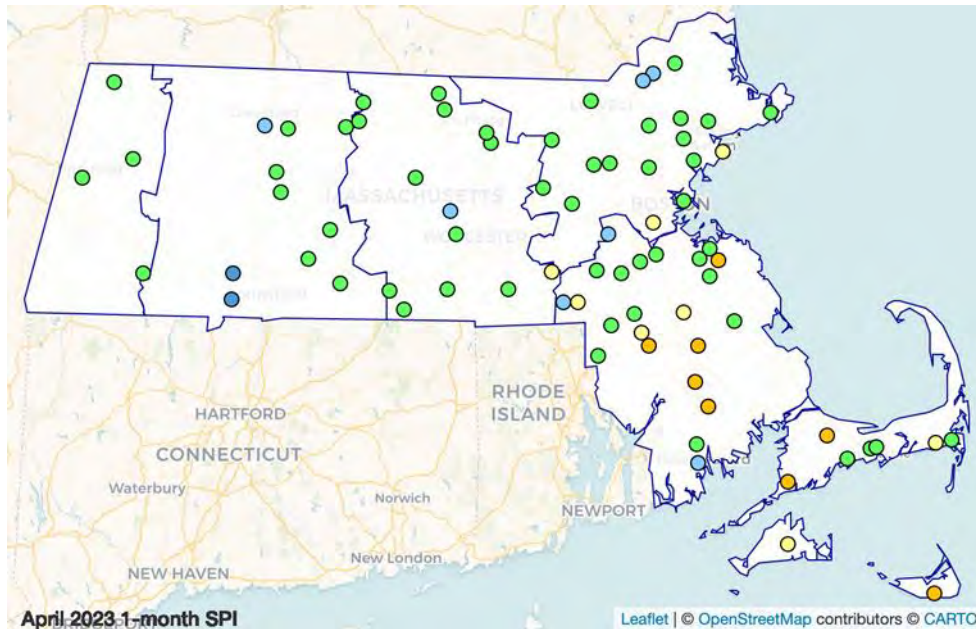
AVERAGE TEMPERATURE DEPARTURE





STANDARDIZED PRECIPITATION INDEX (SPI) AS A PERCENTILE

April precipitation was below normal to above normal at individual sites. Areas of below-normal precipitation were in the southeastern parts of the state. The first half of April was dry, but storms in the later part of the month helped to make up deficits. The Islands Region is at an elevated ISL for April as well as longer look-back periods. Cape Cod is 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	APRIL MONTHLY AVERAGE (IN)	DEPARTURE FROM HISTORICAL (IN)	SPI PERCENTILE 1-MONTH	SPI PERCENTILE 3-MONTH	SPI PERCENTILE 6-MONTH
WESTERN	4	3.60	0.05	59	46	68
CTRV	10	4.26	0.54	60	41	76
CENTRAL	14	3.73	-0.24	54	35	74
NORTHEAST	19	3.72	-0.10	54	40	67
SOUTHEAST	23	3.48	-0.69	38	32	60
CAPE COD	7	3.38	-0.70	31	25	66
ISLANDS	2	2.19	-1.29	21	5	30

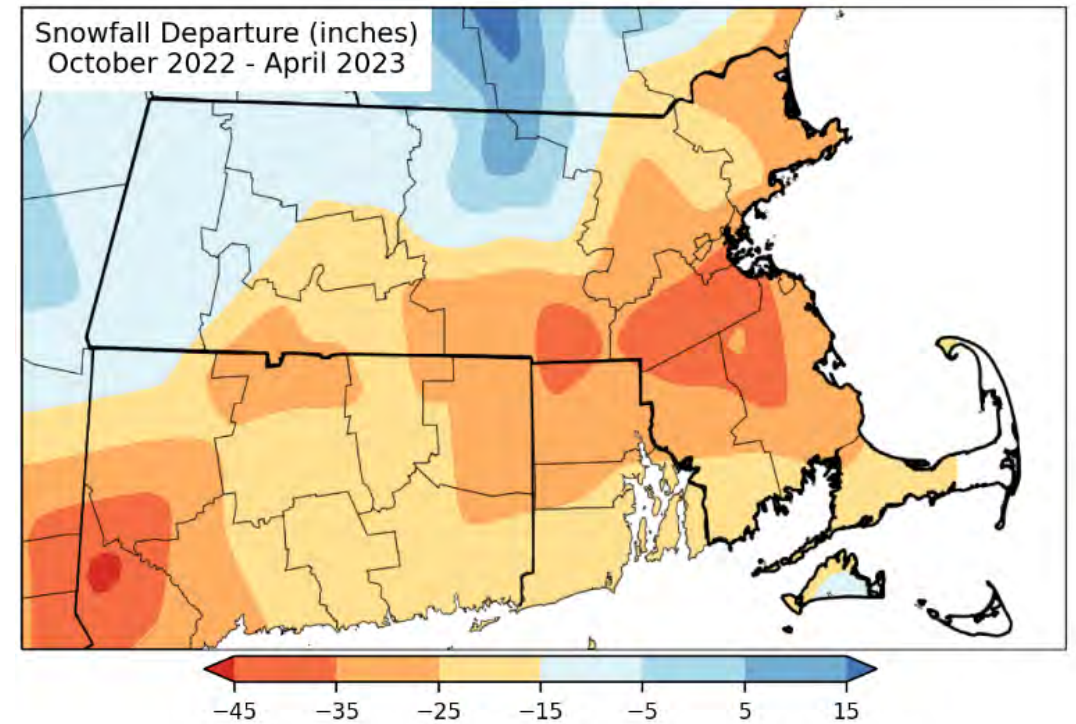
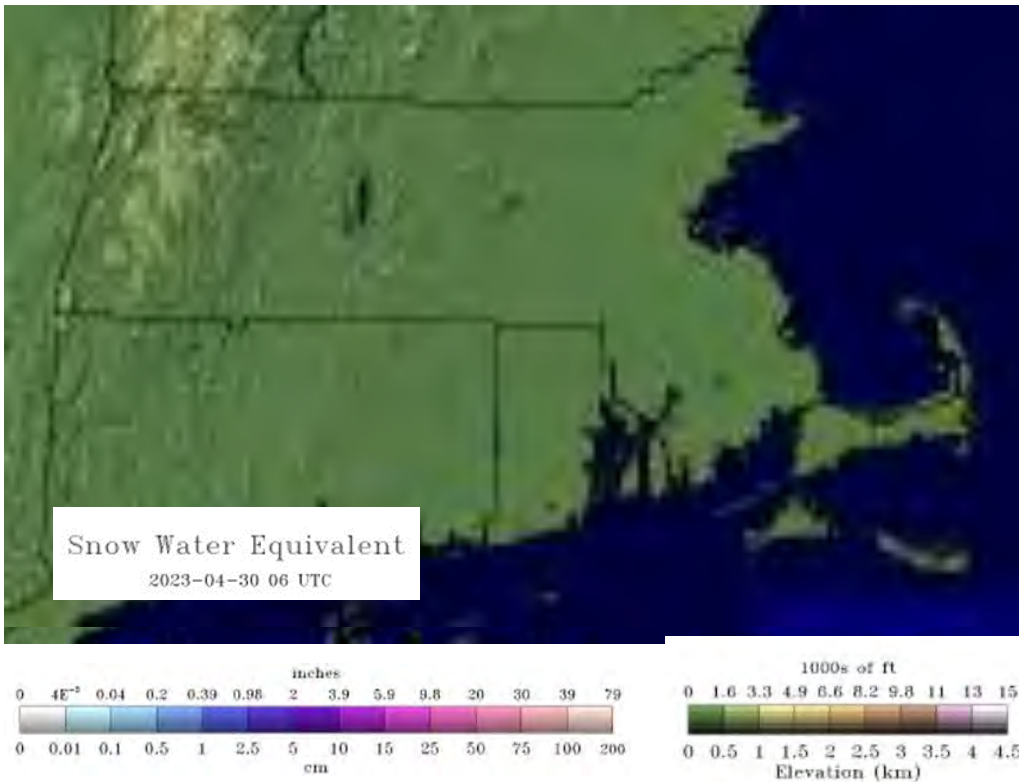
SPI is the Standardized Precipitation Index used in the Drought Management Plan (DMP) expressed here as a percentile and represents the variation from long-term precipitation.

DMP Index Severity Levels			
1	2	3	4

SNOW COVER

At the end of April, there was no snow cover remaining in Massachusetts. Snowfall was below average for the season except in northern central part of the state.

<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 April 29, 2023 from NOAA's National Weather Service Climate Prediction Center were: 1.77 and 1.34 in the western and central parts of the state respectively, which both are in the abnormally moist range, and 1.00 in the coastal part of the state, which is in the slightly dry/favorably moist range.

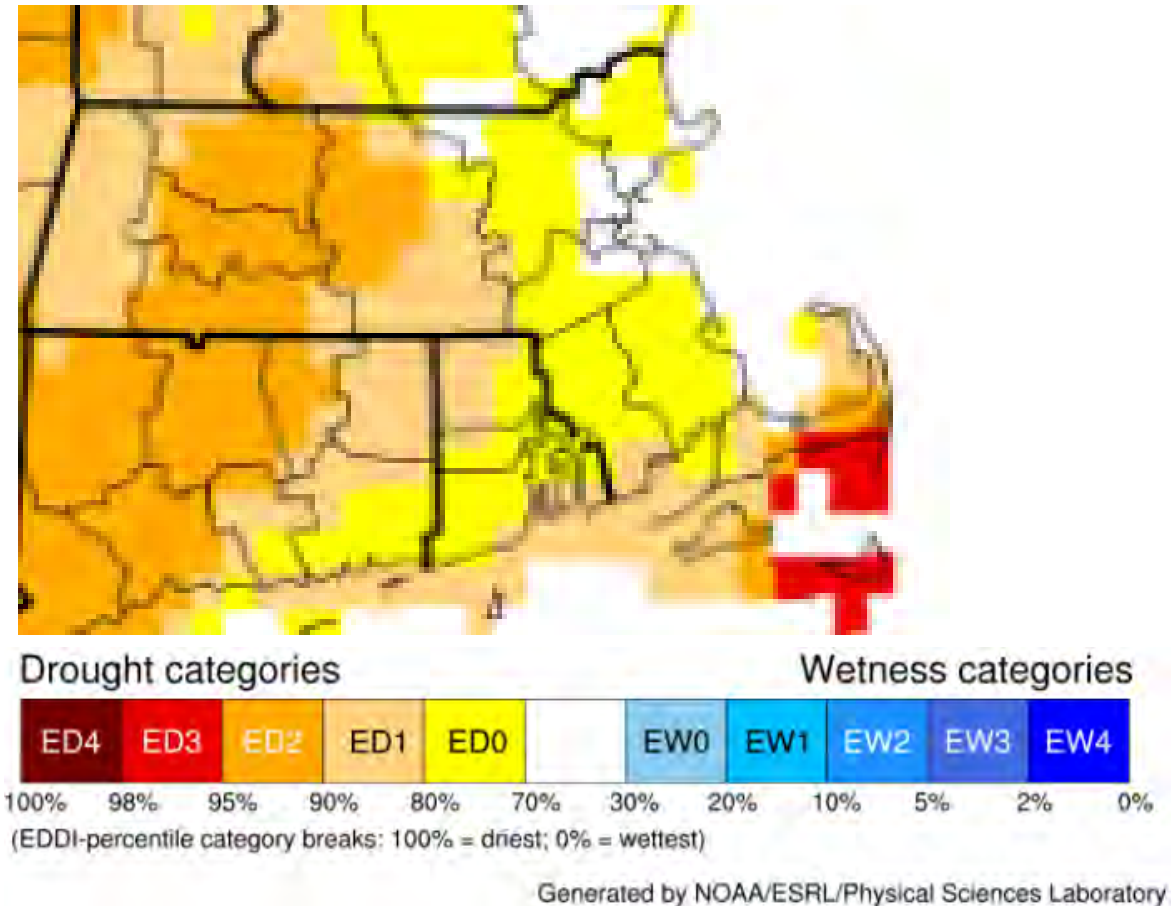
https://www.cpc.ncep.noaa.gov/products/monitoring_and_data/drought.shtml





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

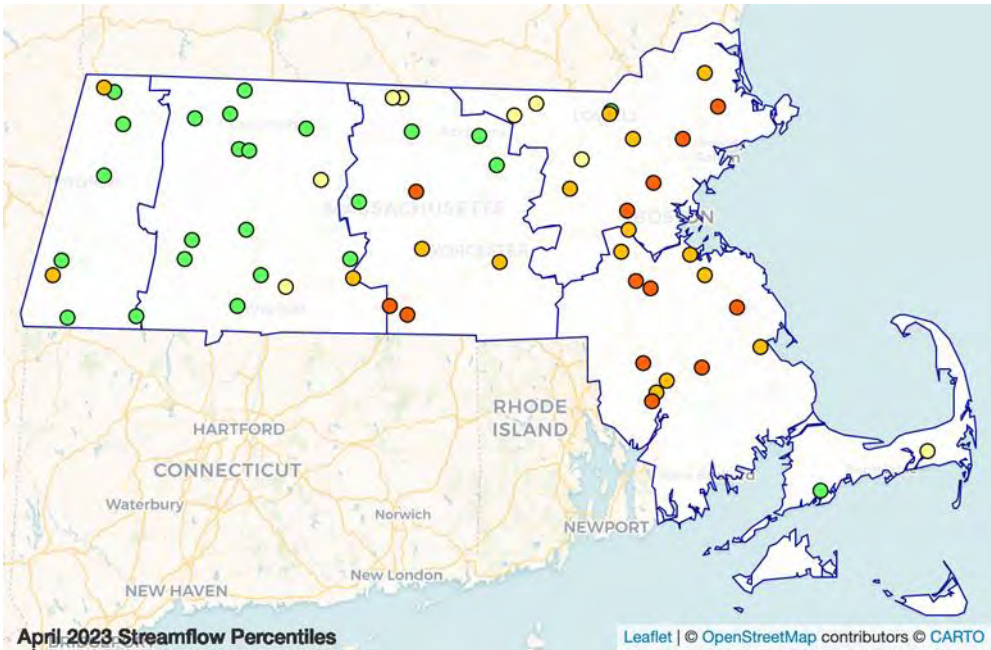
The 1-mos EDDI categories for April 30, 2023 were at elevated levels across the majority of the state.





During April, percentiles of individual streamflow gages varied across the state below normal to normal. Regional medians were lower in the eastern half of the state. The Central Region is at ISL 1, the Northeast Region is at ISL 2, and the Southeast Region is at ISL 3.

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	2	0	0	38
CTRV	15	0	0	1	2	0	48
CENTRAL	11	0	3	2	2	0	27
NORTHEAST	13	0	4	5	3	0	15
SOUTHEAST	12	0	6	6	0	0	10
CAPE COD	2	0	0	0	1	0	33

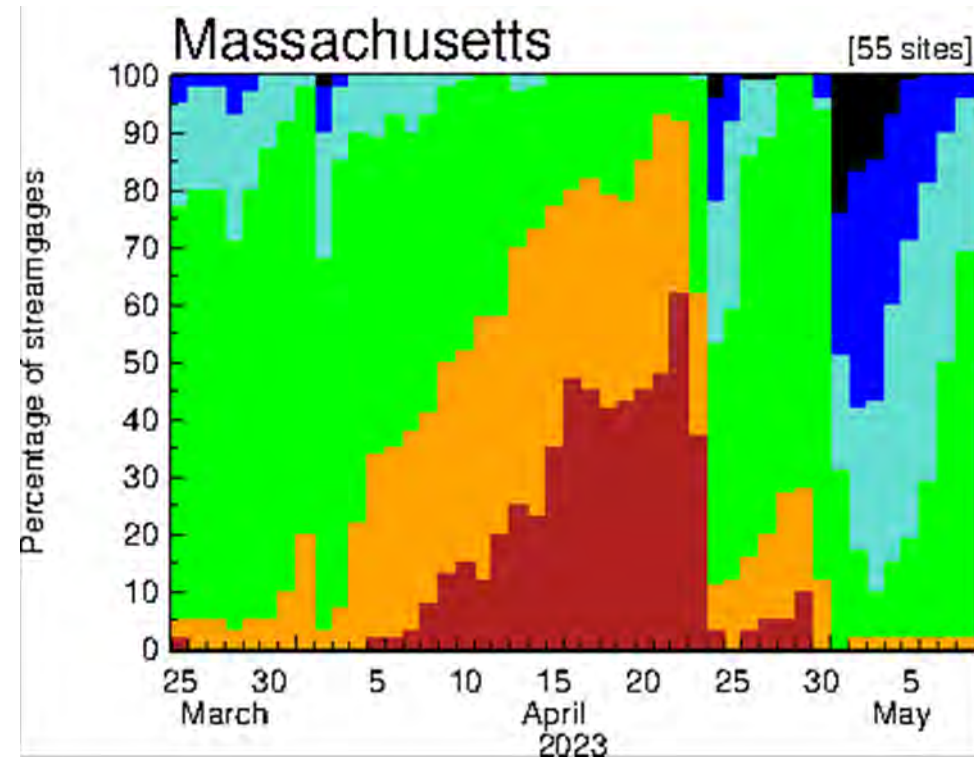
Note: Not all gages report in all months due to ice, beaver dams or other conditions. Streamflow index is not applicable to the Islands.

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 April 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.

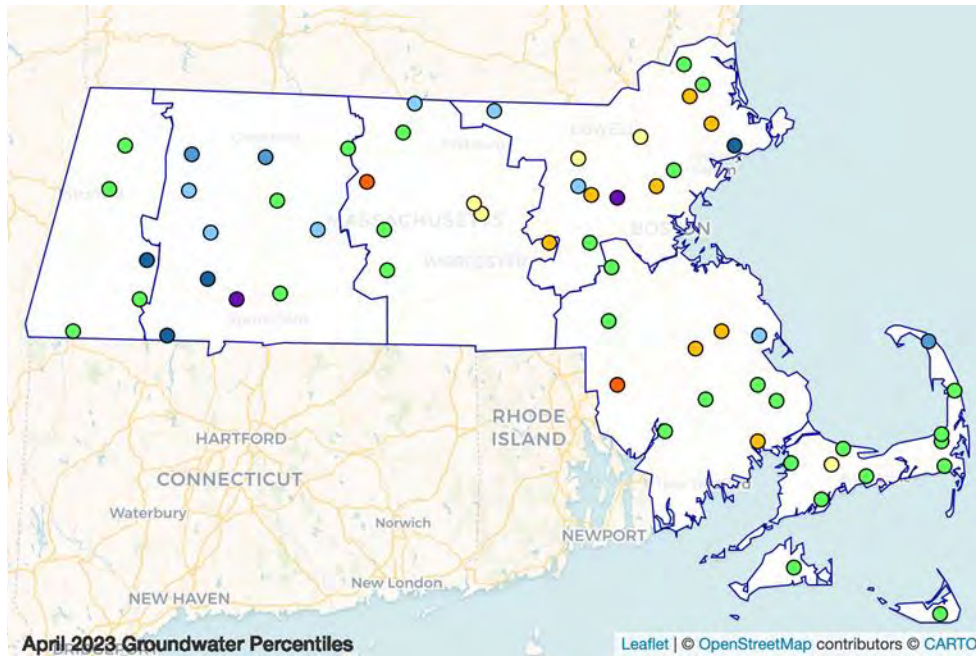


Image: Courtesy of NASA/JPL-Caltech



March groundwater levels ranged from below normal to above normal across the state. Regional medians of individual well percentiles were in the normal range except for the Central Region, which is at ISL 1.

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	1	53
CTRV	11	0	0	0	0	3	78
CENTRAL	8	0	1	1	2	0	30
NORTHEAST	14	0	0	4	2	2	36
SOUTHEAST	12	0	1	3	0	0	41
CAPE COD	10	0	0	0	1	0	50
ISLANDS	2	0	0	0	0	0	49

DMP Index Severity Levels			
1	2	3	4



At the end of April, 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	2	74th
NORTHEAST	5	39th
SOUTHEAST	2	55th
CAPE COD	1	17th

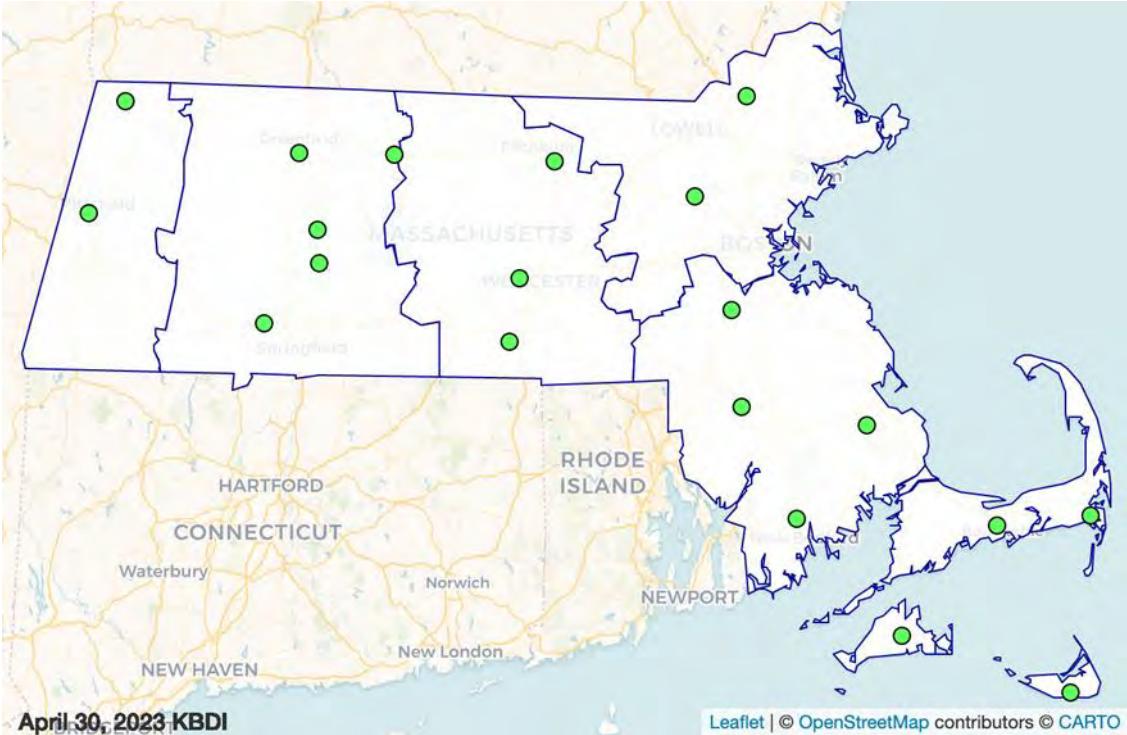
DMP Index Severity Levels do not necessarily reflect water supply status.

DMP Index Severity Levels			
1	2	3	4





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



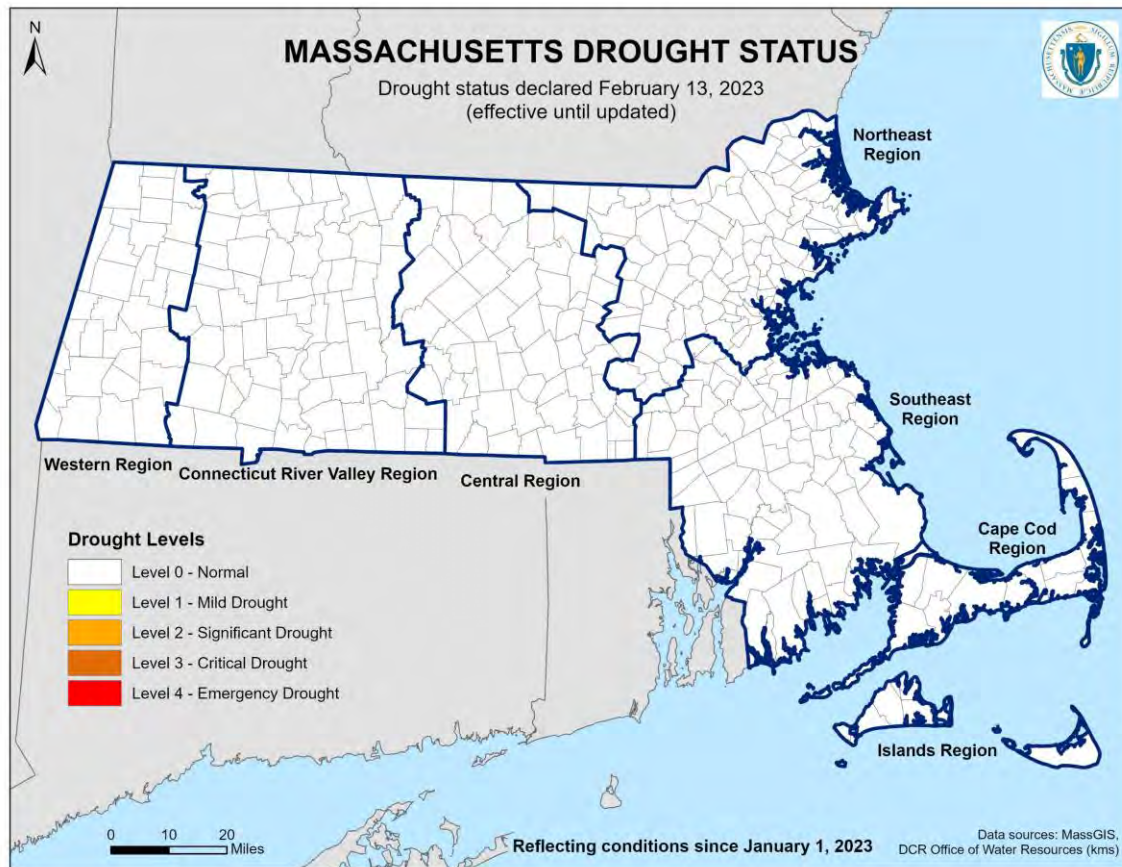
REGION	NUMBER OF SITES REPORTING	HIGHEST OF SITE VALUES
WESTERN	2	0
CTRV	5	2
CENTRAL	3	18
NORTHEAST	2	0
SOUTHEAST	4	0
CAPE COD	2	0
ISLANDS	2	0

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

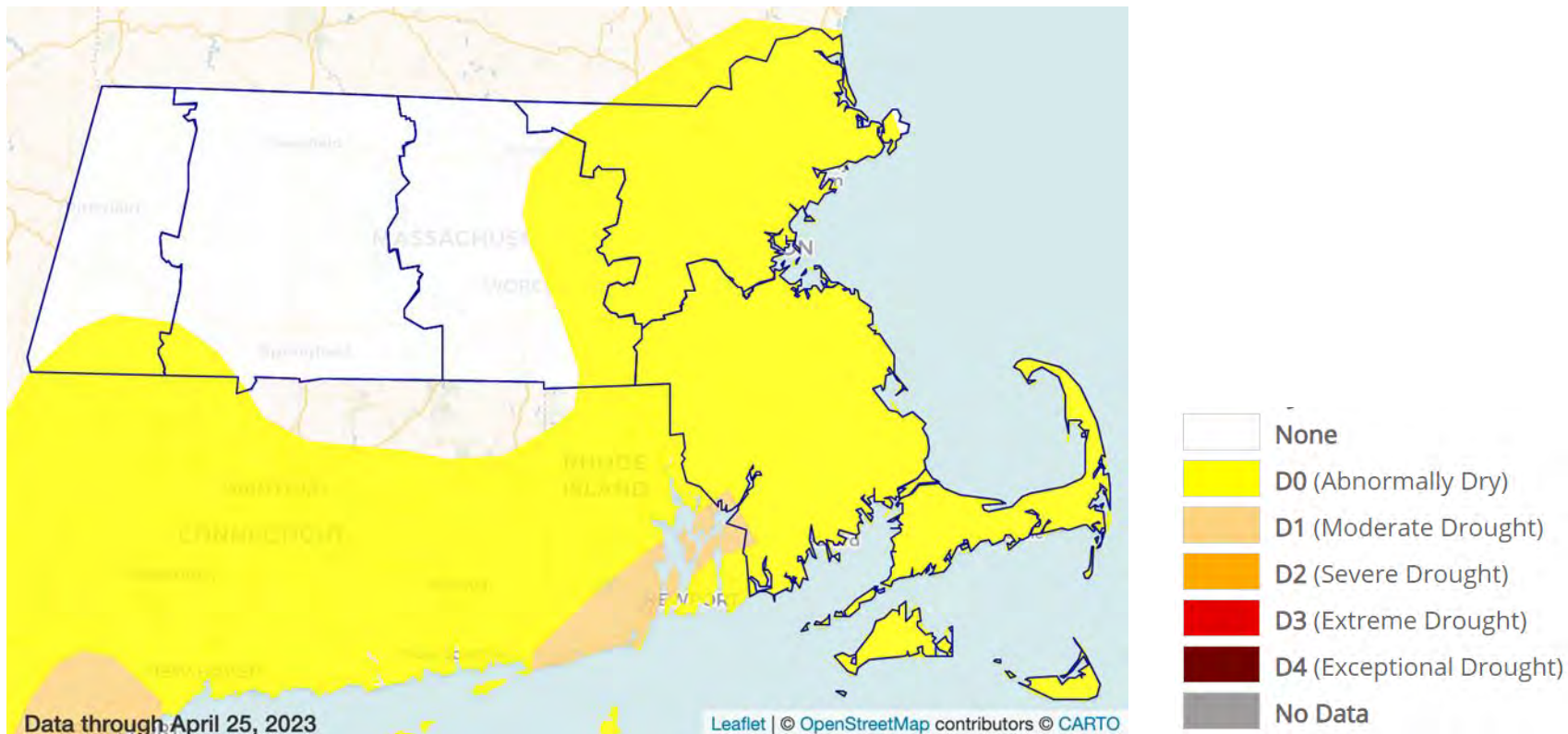
On February 13, 2023, Massachusetts Energy and Environmental Affairs (EEA) Secretary Rebecca L. Tepper declared that starting from January 2023, the Western, Connecticut River Valley, Central, Northeast, Southeast, Cape Cod, and Islands Regions are at Level 0 Normal Conditions. This status remains in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



U.S. DROUGHT MONITOR (USDM)

At the end of April, the USDM showed areas of D0 (Abnormally Dry) in the eastern half and southwestern part of the state.

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

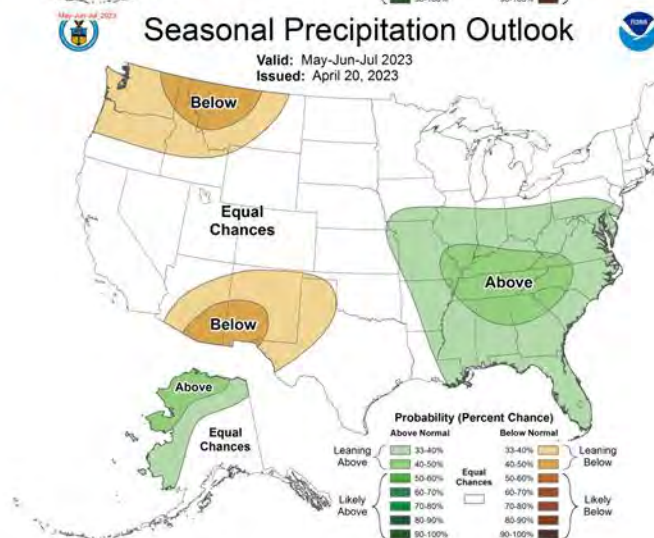
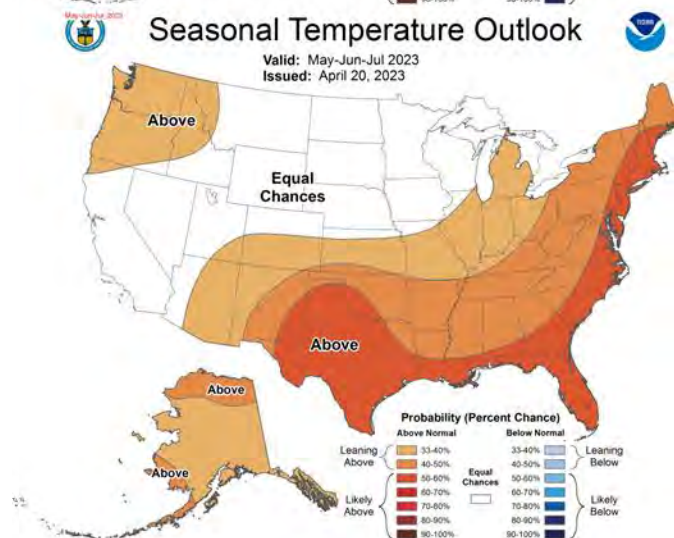
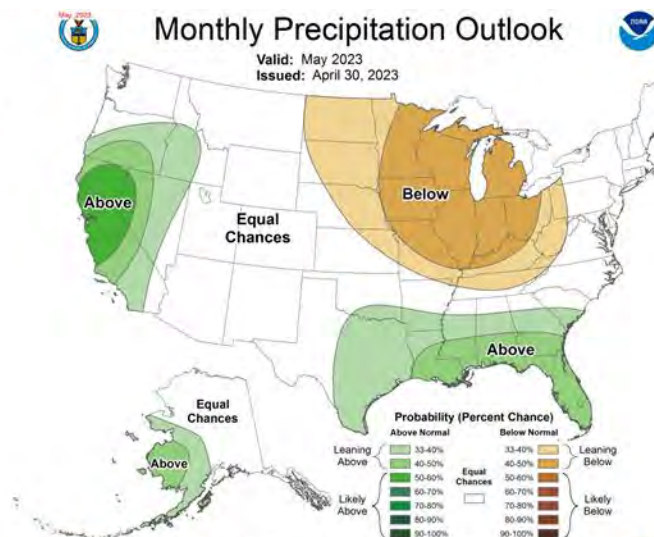
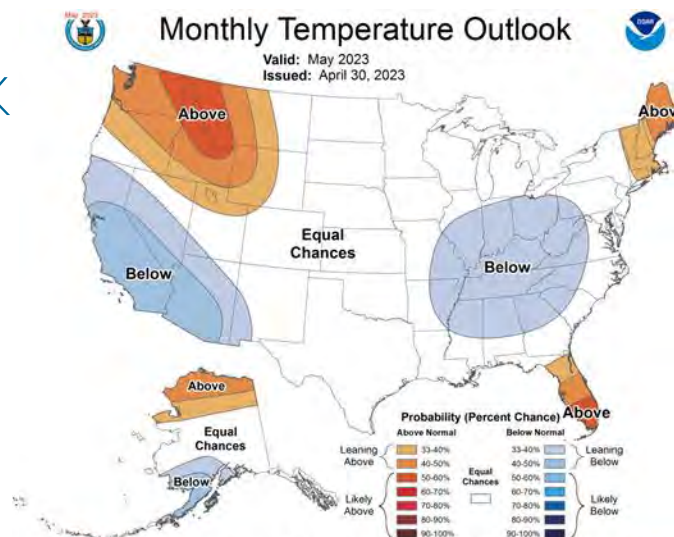


TEMPERATURE AND PRECIPITATION OUTLOOK

May: The outlook issued 4/30 shows a 33-40% chance of above normal temperatures and equal chances for above-normal, normal, or below-normal precipitation.

May through July: The seasonal outlook issued 4/20 shows a 50-60% chance of above-normal temperatures and equal chances for above-normal, normal, or below-normal precipitation.

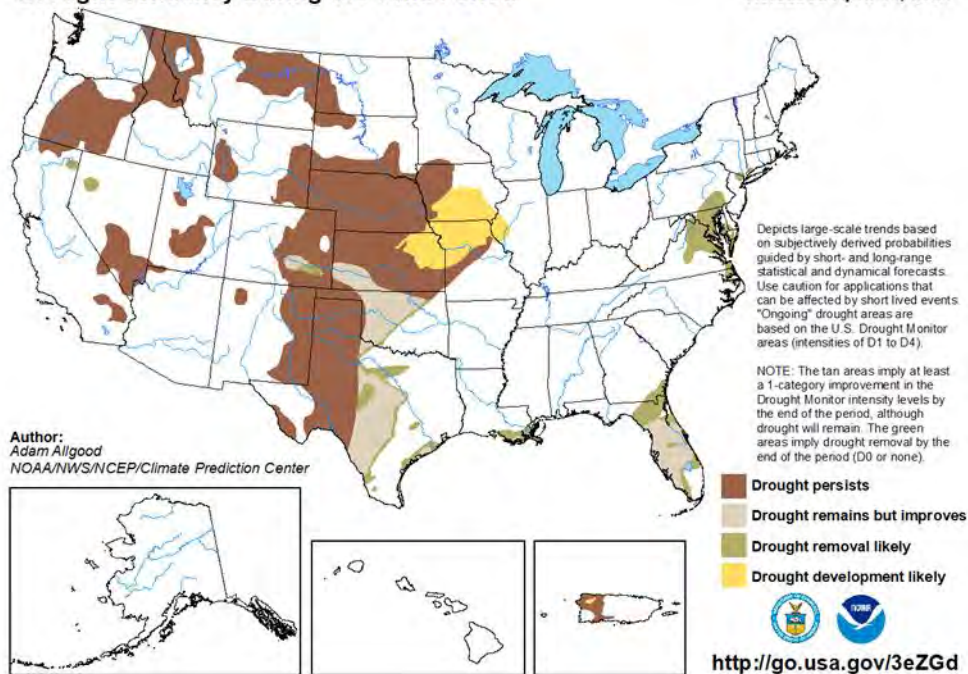
<https://www.cpc.ncep.noaa.gov/>



U.S. Monthly Drought Outlook

Drought Tendency During the Valid Period

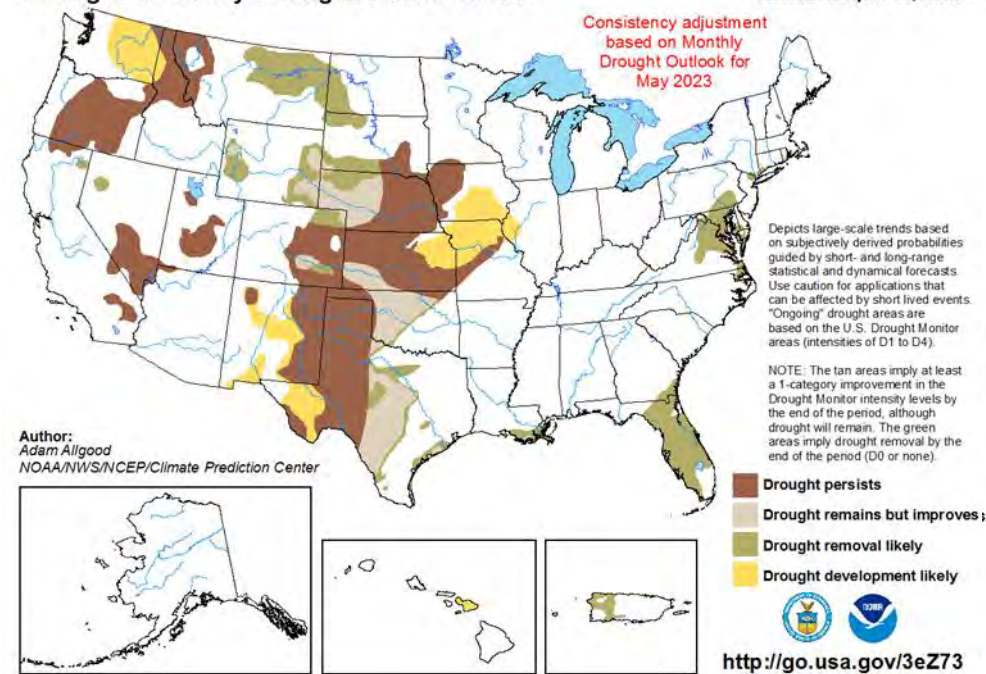
Valid for May 2023
Released April 30, 2023



U.S. Seasonal Drought Outlook

Drought Tendency During the Valid Period

Valid for May 1 - July 31, 2023
Released April 30, 2023



MONTHLY AND SEASONAL DROUGHT OUTLOOK

The monthly outlook for May released on 4/33 shows no drought development in Massachusetts.

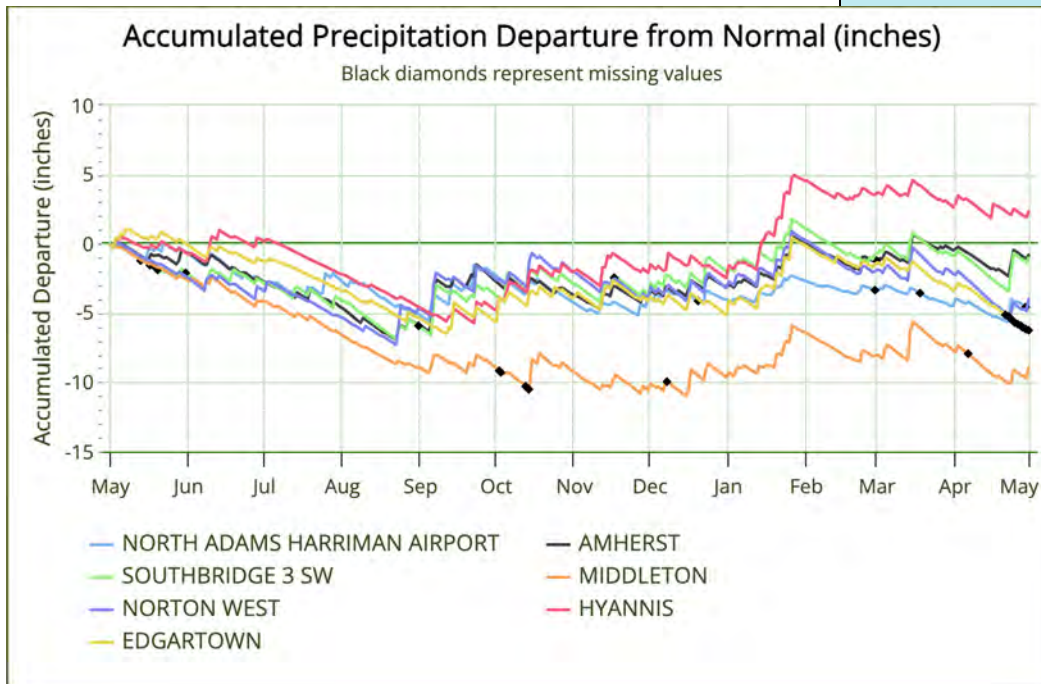
The seasonal outlook for May through July issued on 4/30 shows no drought development in Massachusetts.

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

ADDITIONAL PRECIPITATION DATA

Standardized Precipitation Index— April 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	59	65	46	68	56	33	87	67
CTRV	10	60	61	41	76	73	53	82	66
CENTRAL	14	54	59	35	74	75	53	89	75
NORTHEAST	19	54	63	40	67	51	26	73	69
SOUTHEAST	23	38	51	32	60	76	46	76	60
CAPE COD	7	31	30	25	66	75	53	78	51
ISLANDS	2	21	9	5	30	36	27	-999	-999



DMP Index Severity Levels			
1	2	3	4

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—April 2023

REGION	NUMBER OF SITES REPORTING	HISTORICAL AVERAGE	APRIL AVERAGE (IN)	DEPARTURE FROM HISTORICAL AVERAGE (IN)	PERCENT OF NORMAL
WESTERN	4	3.55	3.60	0.05	101%
CTRV	10	3.72	4.26	0.54	115%
CENTRAL	14	3.97	3.73	-0.24	94%
NORTHEAST	19	3.82	3.72	-0.10	97%
SOUTHEAST	23	4.17	3.48	-0.69	83%
CAPE COD	7	4.08	3.38	-0.70	83%
ISLANDS	2	3.48	2.19	-1.29	63%

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