

MASSACHUSETTS WATER RESOURCES COMMISSION

HYDROLOGIC CONDITIONS IN MASSACHUSETTS

OCTOBER
2023

The Commonwealth of Massachusetts

Maura T. Healey, Governor

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



OCTOBER 2023 HYDROLOGIC CONDITIONS

SUMMARY OF CONDITIONS



- Monthly average temperatures were above normal.



- Precipitation was below normal to normal. Below-normal areas include the Southeast, Cape Cod, and Islands Regions. There was no snow cover at the end of October.



- Crop Moisture Index showed Abnormally Moist and Slightly Dry/Favorably Moist conditions across the state at the end of the month. The 1-month and 2-month Evaporative Demand Drought Index maps showed normal to below normal.



- The Keetch-Byram Drought Index showed normal soil moisture conditions at the end of the month.
- Streamflow was above normal except for the Cape Cod Region where it was normal.



- Groundwater was below normal to much above normal. The Islands Region is the only region elevated at ISL 2.



- Lake and impoundment levels were above their 30th percentile and/or were at or near 100% full.



- NOAA's November outlook shows chances leaning for below-normal temperatures and equal chances for below-normal, normal, or above-normal precipitation.



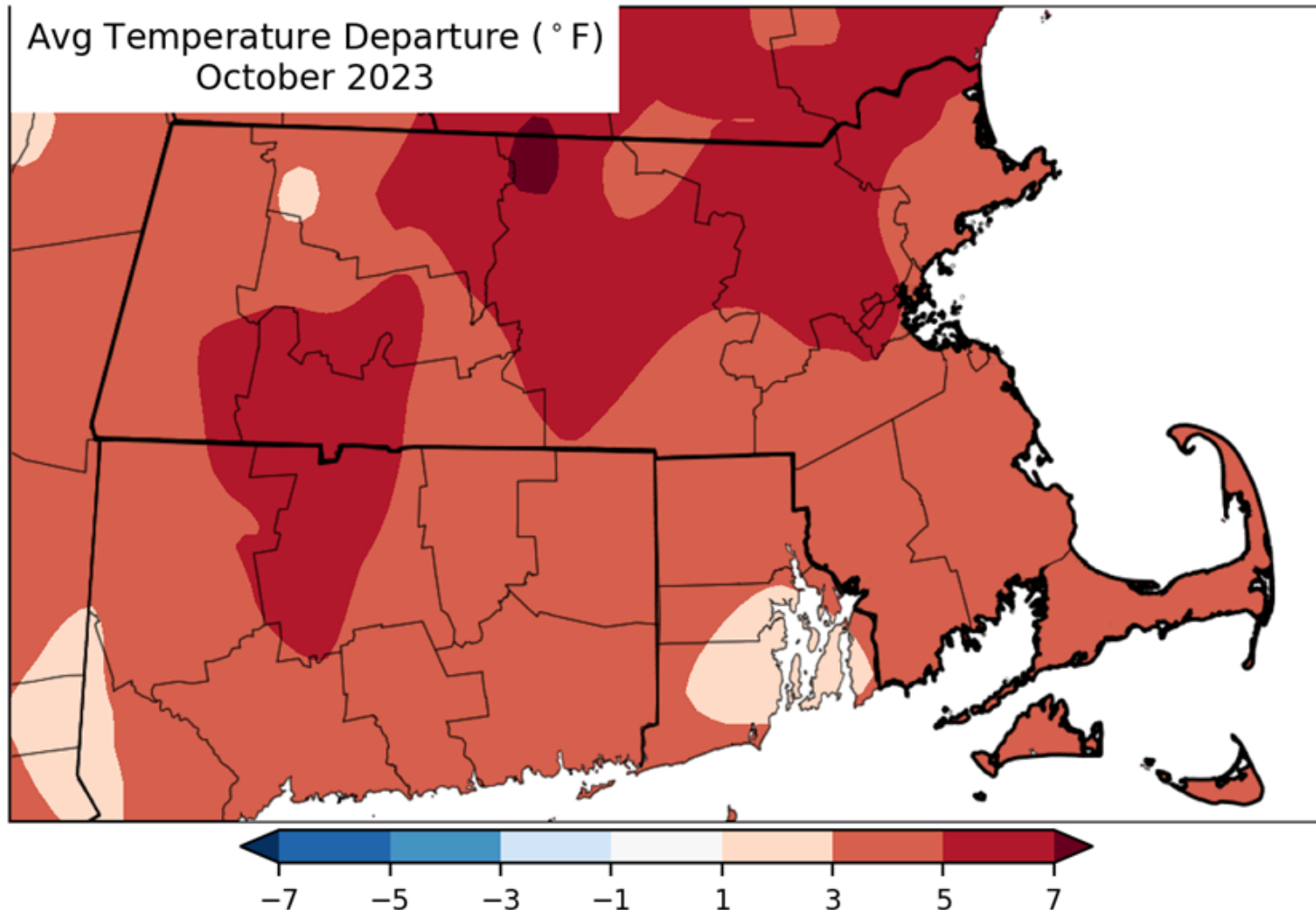
- NOAA's 3-month outlook shows chances likely for above-normal temperatures and equal chances for below-normal, normal, or above-normal precipitation.

- 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 11/06/2023. 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 above normal. According to the Northeast Regional Climate Center (NRCC) the Boston and Worcester climate sites had their 7th warmest October on record and Massachusetts its 2nd warmest.

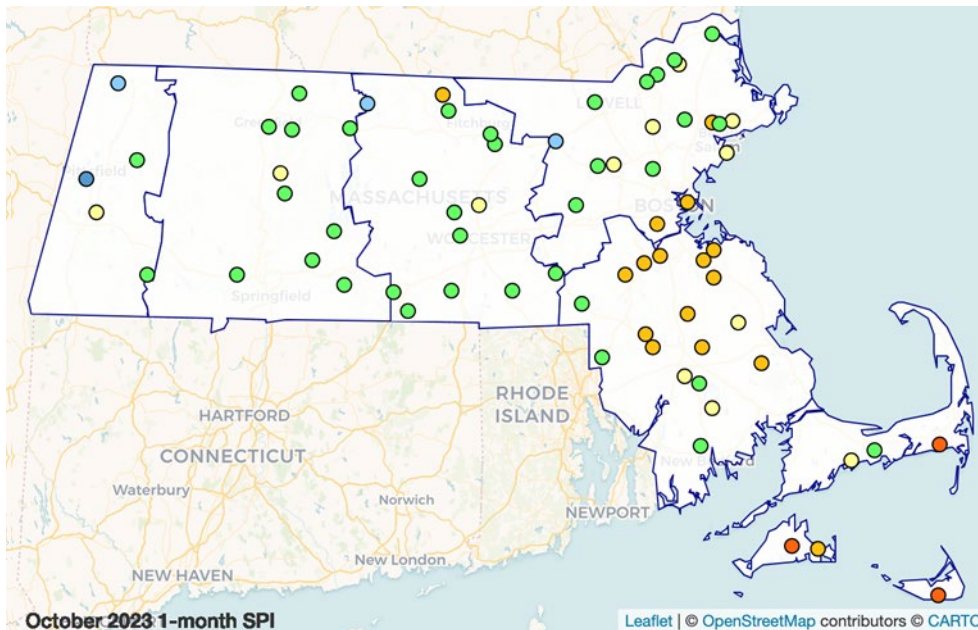
<http://www.nrcc.cornell.edu/regional/monthly/monthly.html>





STANDARDIZED PRECIPITATION INDEX (SPI) AS A PERCENTILE

October precipitation was below normal to normal. Below-normal areas include the Southeast, Cape Cod, and Islands Regions. In addition to the table below, Appendix I provides all the 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	OCTOBER MONTHLY AVERAGE (IN)	DEPARTURE FROM HISTORICAL (IN)	SPI PERCENTILE 1-MONTH	SPI PERCENTILE 3-MONTH	SPI PERCENTILE 6-MONTH
WESTERN	5	4.47	0.24	43	67	88
CTRV	10	3.39	-0.46	44	75	93
CENTRAL	14	3.64	-0.70	42	86	98
NORTHEAST	19	2.76	-1.13	33	92	96
SOUTHEAST	18	2.49	-1.88	19	74	88
CAPE COD	3	2.31	-1.79	23	84	78
ISLANDS	3	1.74	-2.30	10	70	49

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

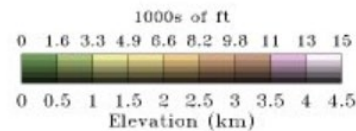
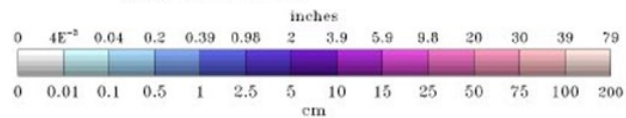
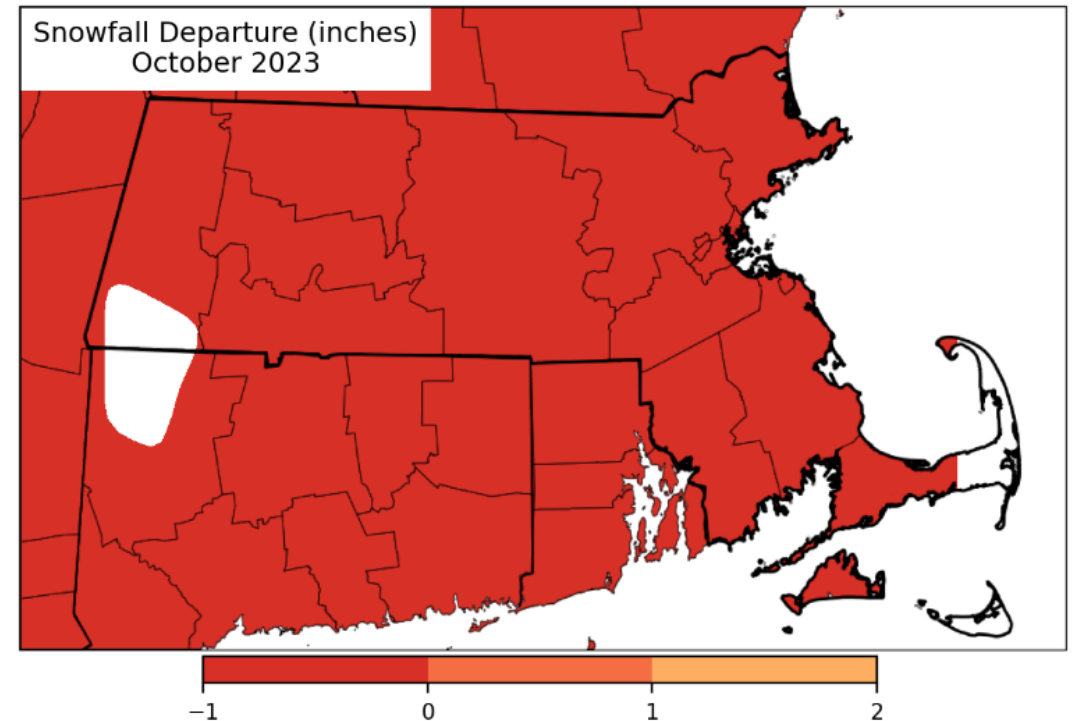
At the end of October, there was no snow cover in Massachusetts.

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



Snow Water Equivalent

2023-10-31 06 UTC

SEASON-TO-DATE
SNOWFALL DEPARTURE

CROP MOISTURE INDEX (CMI)

Weekly values for the period ending October 28, 2023 from NOAA’s National Weather Service Climate Prediction Center were in the Abnormally Moist range in the western climate division and Slightly Dry/Favorably Moist in the central and coastal climate divisions.

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

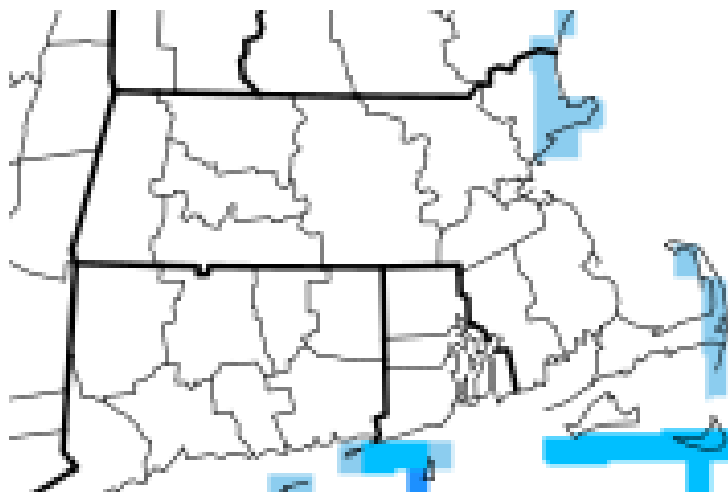
CLIMATE DIVISION	CROP MOISTURE INDEX
WESTERN	1.20
CENTRAL	0.96
COASTAL	0.49



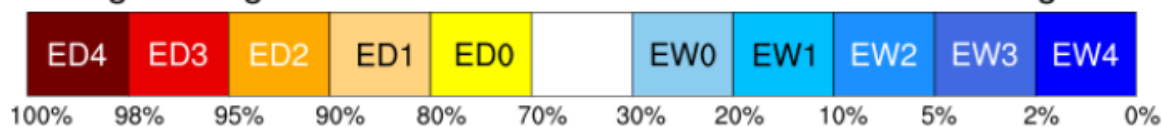
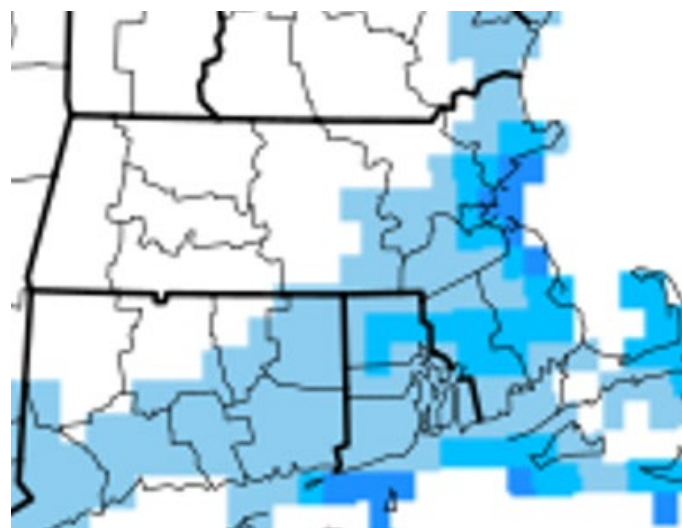
EVAPORATIVE DEMAND DROUGHT INDEX (EDDI)

The 1-month and 2-month EDDI categories for October 31, 2023 were normal to below normal.

1-month EDDI



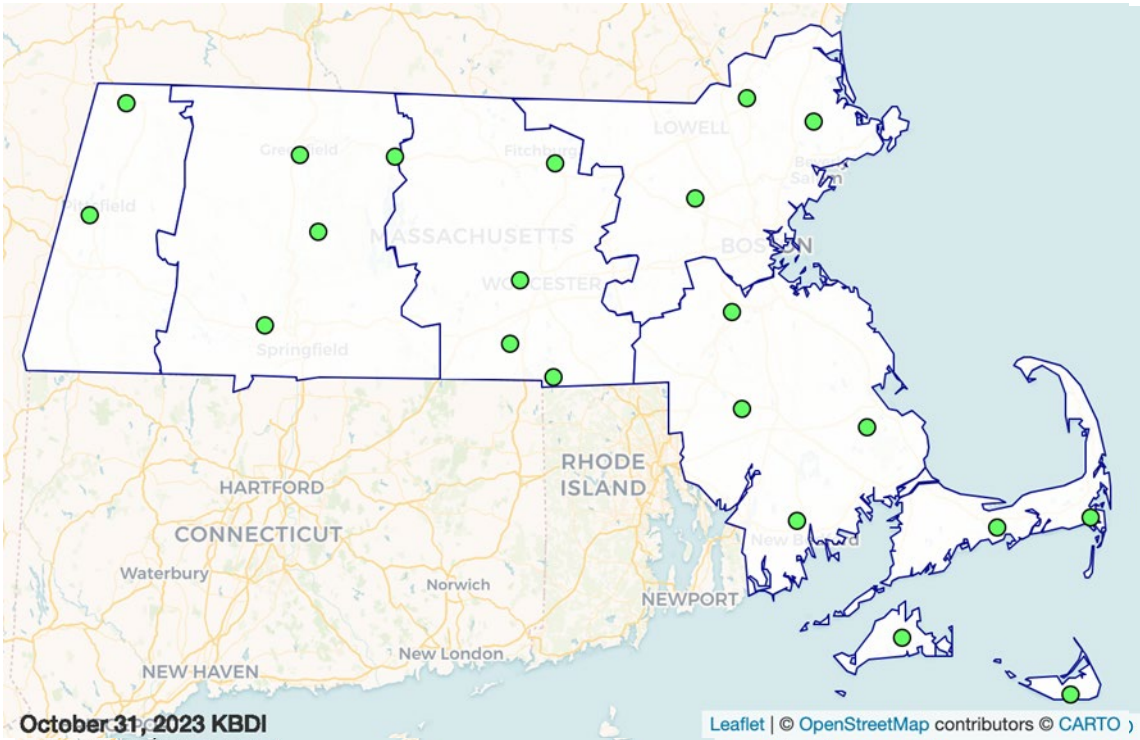
2-month EDDI



Generated by NOAA/ESRL/Physical Sciences Laboratory








At the end of October, the Keetch Byram Drought Index (KBDI) was in the normal range in all Regions.



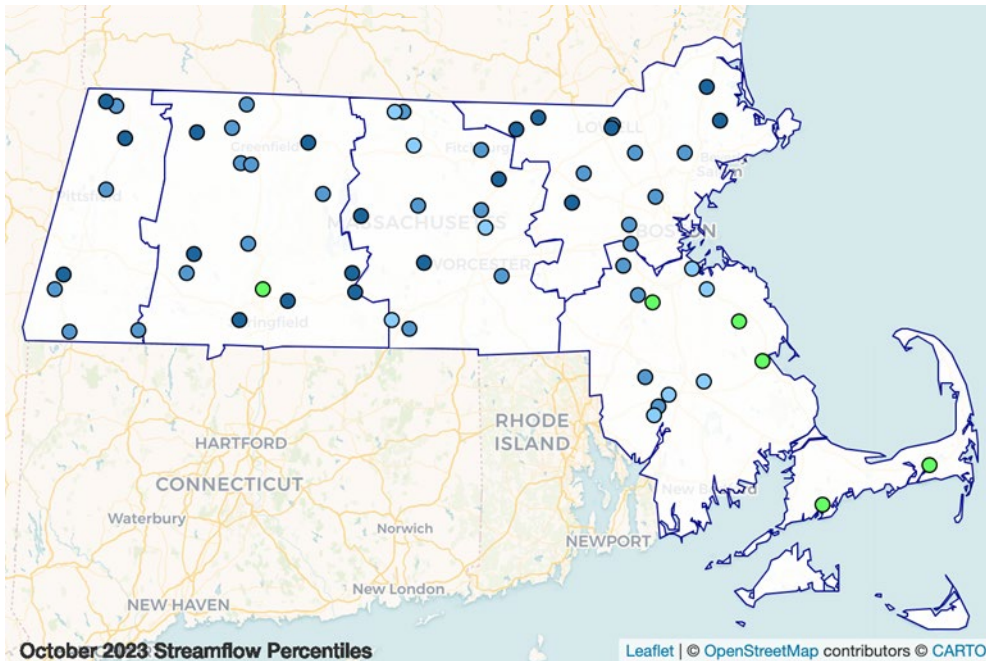
REGION	NUMBER OF SITES REPORTING	HIGHEST OF SITE VALUES
WESTERN	2	0
CTRV	4	1
CENTRAL	4	13
NORTHEAST	3	10
SOUTHEAST	4	28
CAPE COD	2	94
ISLANDS	2	86

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

During October, streamflow was high across the state except for Cape Cod where it was normal. Most percentiles of individual streamflow gages were above normal to much above normal.

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	0	0	3	90
CTRV	15	0	0	0	0	7	90
CENTRAL	13	0	0	0	0	3	87
NORTHEAST	13	0	0	0	0	6	88
SOUTHEAST	12	0	0	0	0	0	78
CAPE COD	2	0	0	0	0	0	54

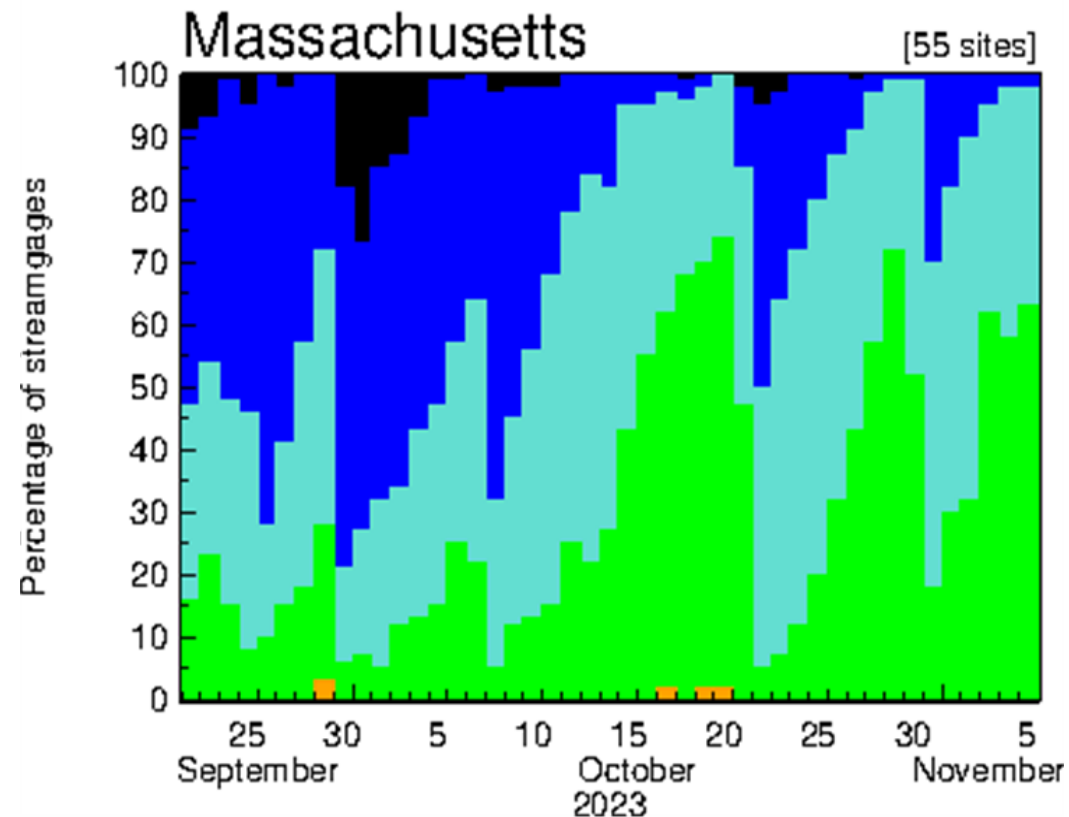
Note: Not all gages report in all months due to ice, beaver dams or other conditions. Streamflow index is not applicable to the Islands.

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		



A search of the Local Storm Report App database on the Iowa State University Iowa Environmental Mesonet website produced two storm reports for Massachusetts. Both were for rainfall occurring on 10/21/23 in Berkshire County in the towns of Pittsfield (2.8”) and Stockbridge (1.62”). There were no flood warnings issued for Massachusetts by NWS during October, and no flooding was reported in the October Norton/Boston NWS E-5 Monthly Report of Hydrologic Conditions.



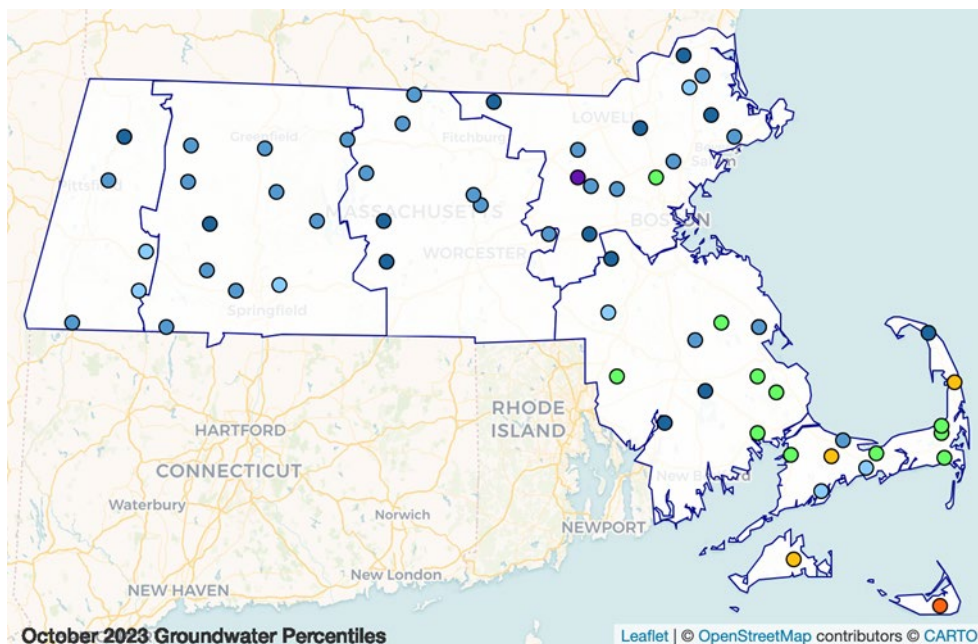
Image: Courtesy of NASA/JPL-Caltech

<https://mesonet.agron.iastate.edu/vtec/search.php#eventsbypoint/-93.6530/41.5300>



October groundwater levels ranged from below normal to much above normal. Regional medians were in the normal to above-normal range in all Regions except for the Islands, which is at ISL 2.

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	85
CTRV	11	0	0	0	0	1	83
CENTRAL	8	0	0	0	0	2	87
NORTHEAST	14	0	0	0	0	6	90
SOUTHEAST	12	0	0	0	0	3	78
CAPE COD	11	0	0	2	0	1	47
ISLANDS	2	0	1	1	0	0	11

DMP Index Severity Levels			
1	2	3	4



At the end of October, reporting lake and impoundment levels were above their 30th percentile and/or were at or near 100% full.

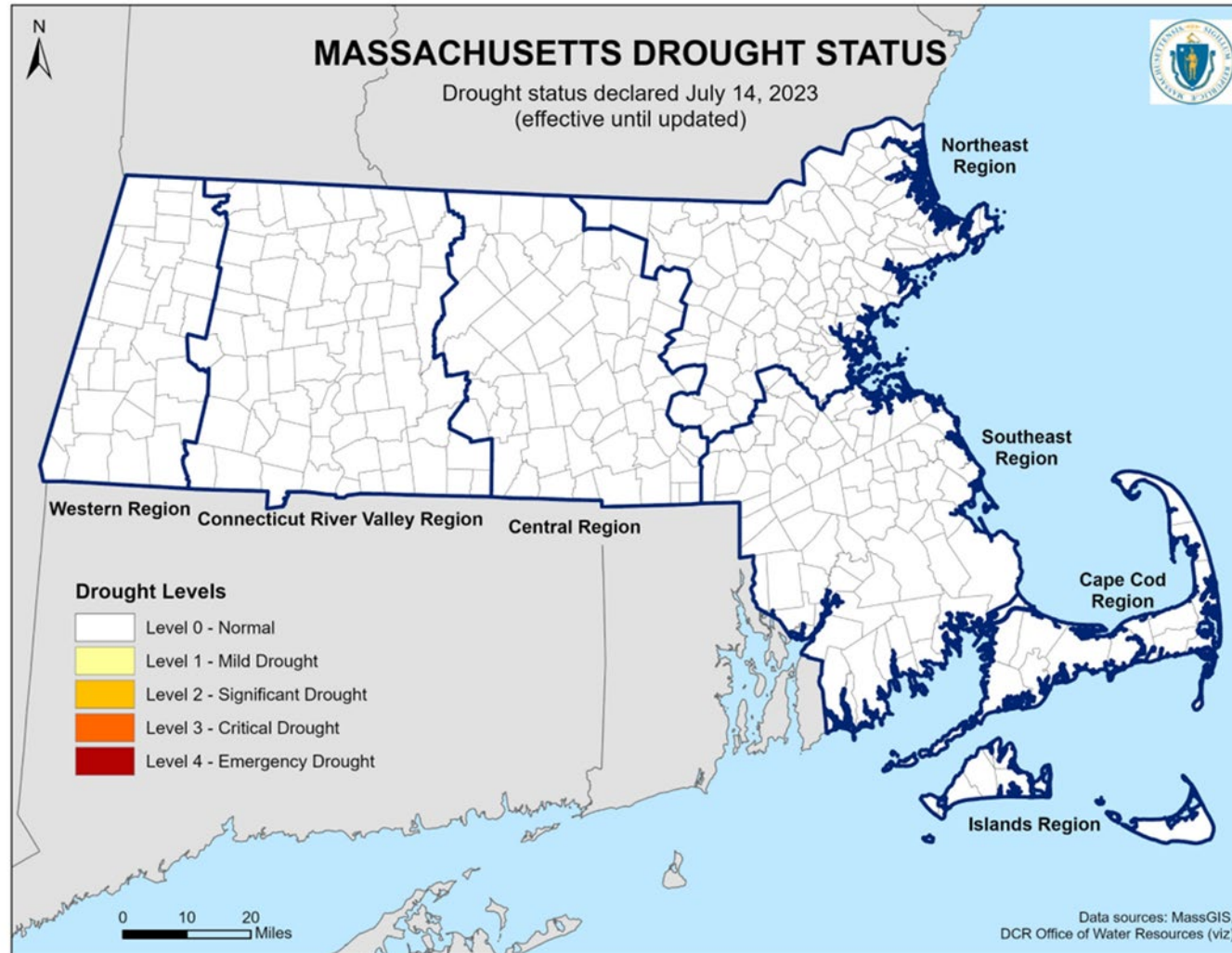
REGION	NUMBER OF SITES REPORTING	MEDIAN OF INDIVIDUAL PERCENTILES OR PERCENT FULL
WESTERN	2	85th
CTRV	2	90th
CENTRAL	1	100th
NORTHEAST	5	94th
SOUTHEAST	2	78th
CAPE COD	1	45th

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

DMP Index Severity Levels			
1	2	3	4



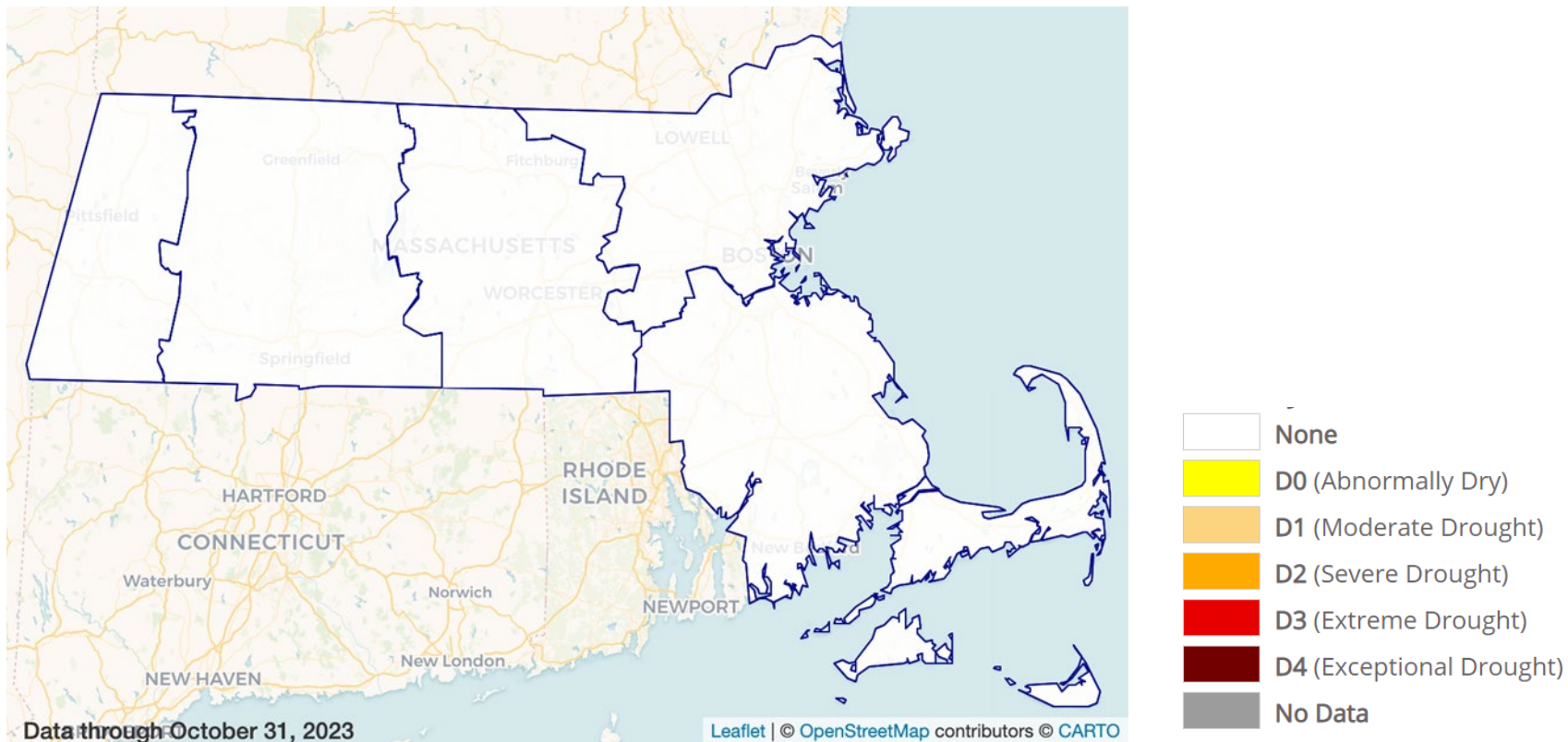
MASSACHUSETTS DROUGHT STATUS



U.S. DROUGHT MONITOR (USDM)

At the end of October, the USDM showed no areas of drought.

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

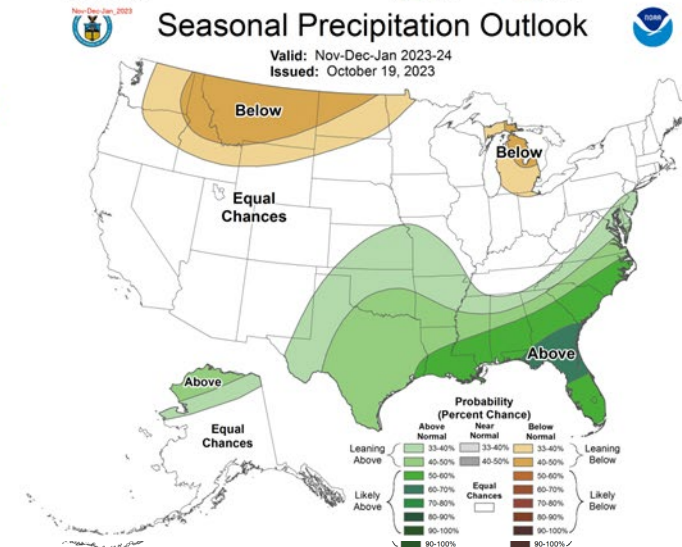
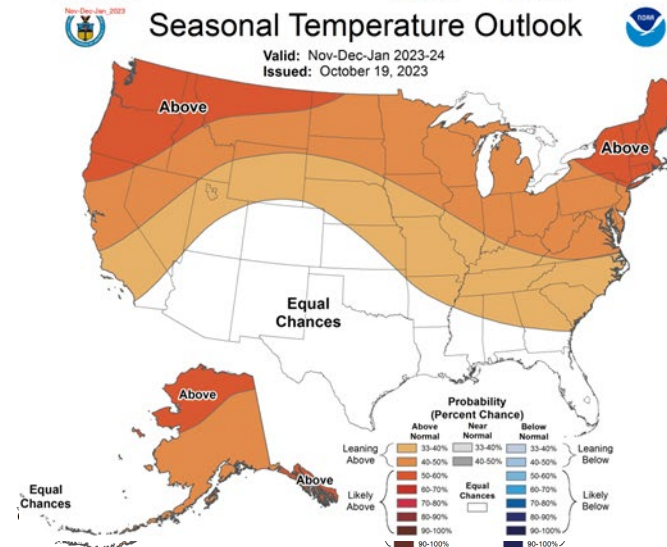
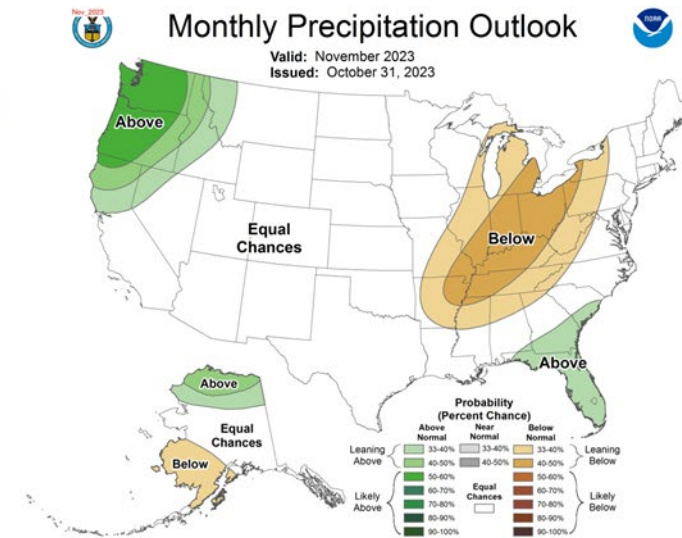
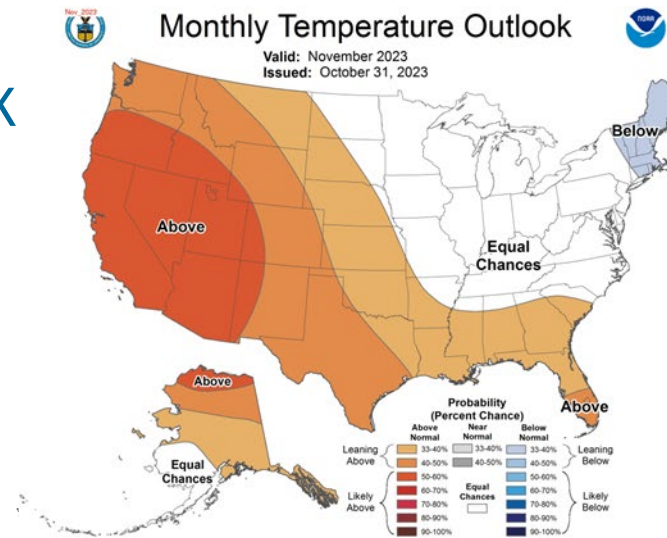


TEMPERATURE AND PRECIPITATION OUTLOOK

November: The outlook issued 10/31 shows a 33-40% chance of below-normal temperatures and equal chances for above-normal, normal, or below-normal precipitation.

November through January: The seasonal outlook issued 10/19 shows a 50-60% chance of above-normal temperatures and equal chances for above-normal, normal, or below-normal precipitation.

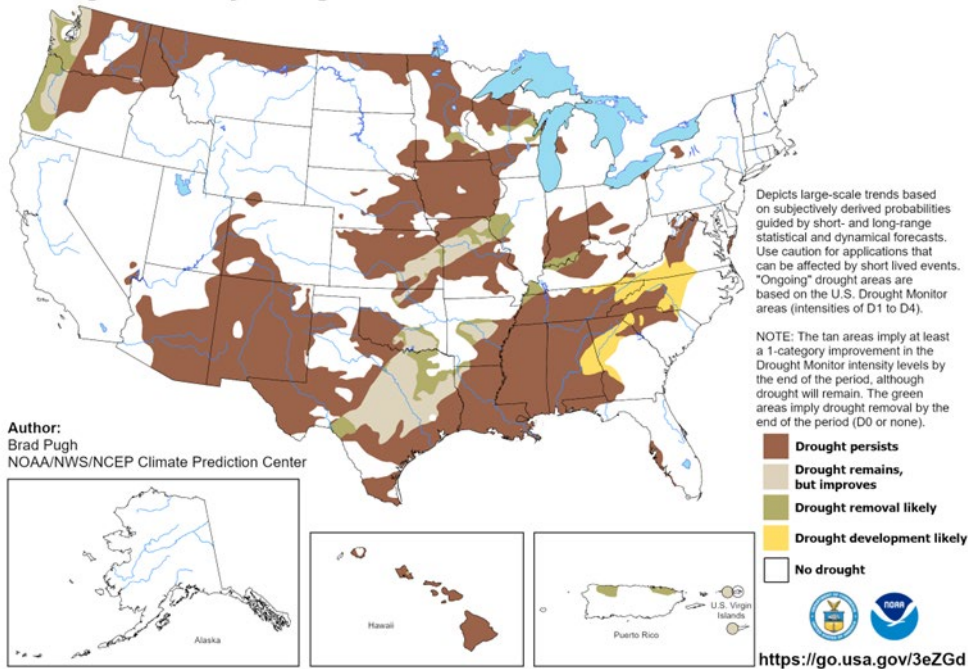
<https://www.cpc.ncep.noaa.gov/>



U.S. Monthly Drought Outlook

Drought Tendency During the Valid Period

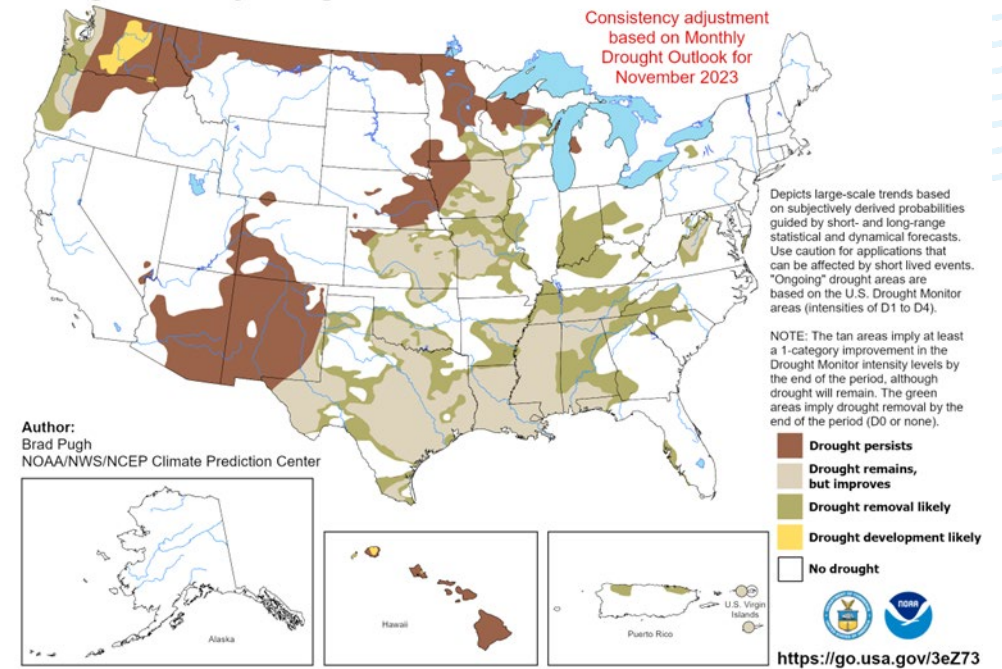
Valid for November 2023
Released October 31, 2023



U.S. Seasonal Drought Outlook

Drought Tendency During the Valid Period

Valid for November 1, 2023 - January 31, 2024
Released October 31, 2023



MONTHLY AND SEASONAL DROUGHT OUTLOOK

The monthly outlook for October released on 9/30 shows no drought development in Massachusetts.

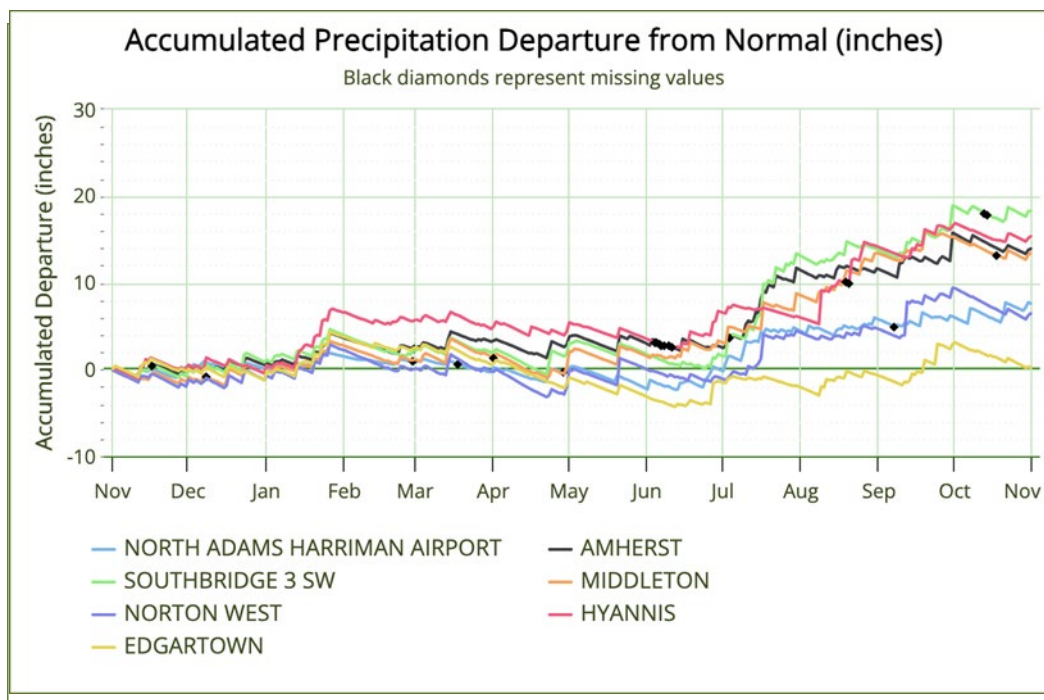
The seasonal outlook for October through December issued on 9/30 shows no drought development in Massachusetts.

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

ADDITIONAL PRECIPITATION DATA

Standardized Precipitation Index— October 2023 as percentiles

REGION	NUMBER OF SITES	1-mo	2-mo	3-mo	6-mo	9-mo	12-mo	24-mo	36-mo
WESTERN	5	43	61	67	88	82	87	68	89
CTRV	10	44	81	75	93	90	92	70	88
CENTRAL	14	42	87	86	98	95	97	84	96
NORTHEAST	19	33	60	92	96	95	95	64	87
SOUTHEAST	18	19	66	74	88	73	80	50	83
CAPE COD	3	23	68	84	78	71	89	73	87
ISLANDS	3	10	65	70	49	15	48	5	41



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—October 2023

REGION	NUMBER OF SITES REPORTING	HISTORICAL AVERAGE	OCTOBER AVERAGE (IN)	DEPARTURE FROM HISTORICAL AVERAGE (IN)	PERCENT OF NORMAL
WESTERN	5	4.23	4.47	0.24	106%
CTRV	10	3.85	3.39	-0.46	88%
CENTRAL	14	4.34	3.64	-0.70	84%
NORTHEAST	19	3.89	2.76	-1.13	71%
SOUTHEAST	18	4.37	2.49	-1.88	57%
CAPE COD	3	4.10	2.31	-1.79	56%
ISLANDS	3	4.04	1.74	-2.30	43%



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