

The Massachusetts Drought Story

A Changing Experience

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Overview

- Drought management in MA
- Changing droughts
- Adapting to changing droughts
 - Revising drought indices
 - More real-time monitoring
 - Automated data analyses – Drought Dashboard

MA Drought Management



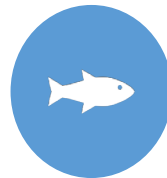
Precipitation (57)



Streamflow (59)



Groundwater (63)



Lakes and
Impoundments (20)



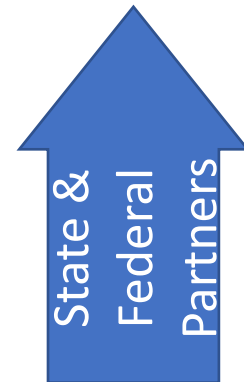
KBDI - Fire Danger (16)



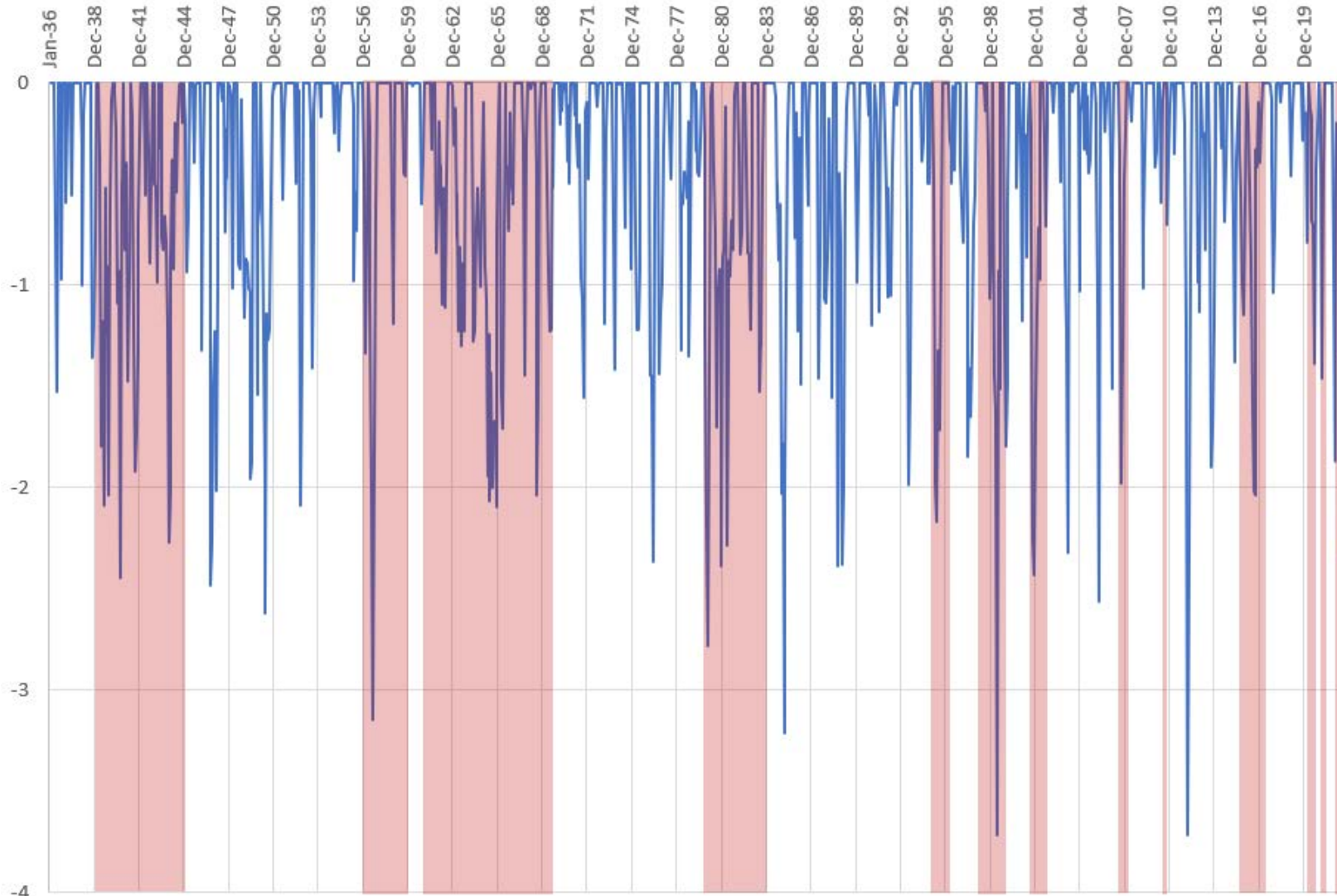
Crop Moisture (national map)



Drought Management Task Force



Shorter but more frequent & faster onset/intensification droughts

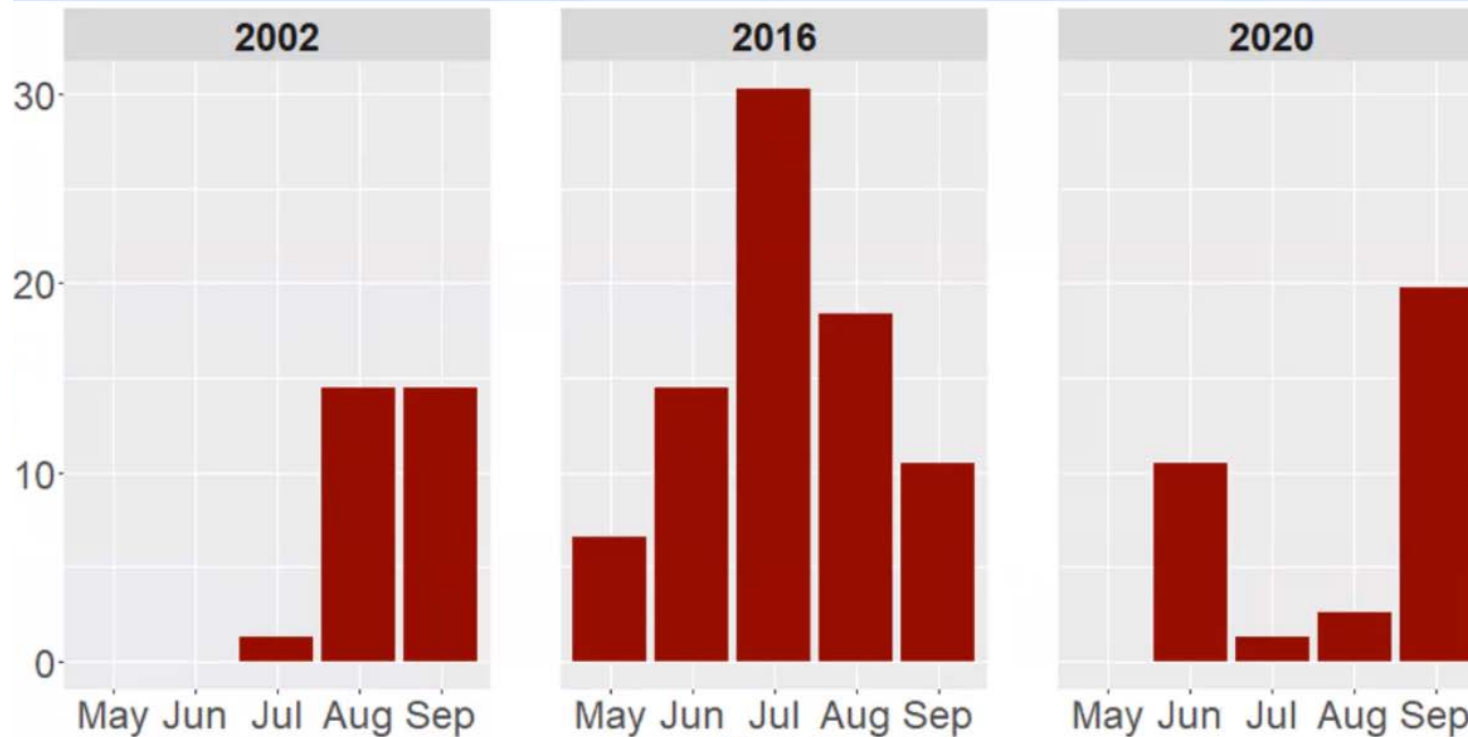


**Negative, 3-month Standardized
Precipitation Index for Boston
1936-2022**

Greater Impacts: Record Low Q and Gw

Streamflow, Percent of Sites with Record Lows

U.S. Geological Survey

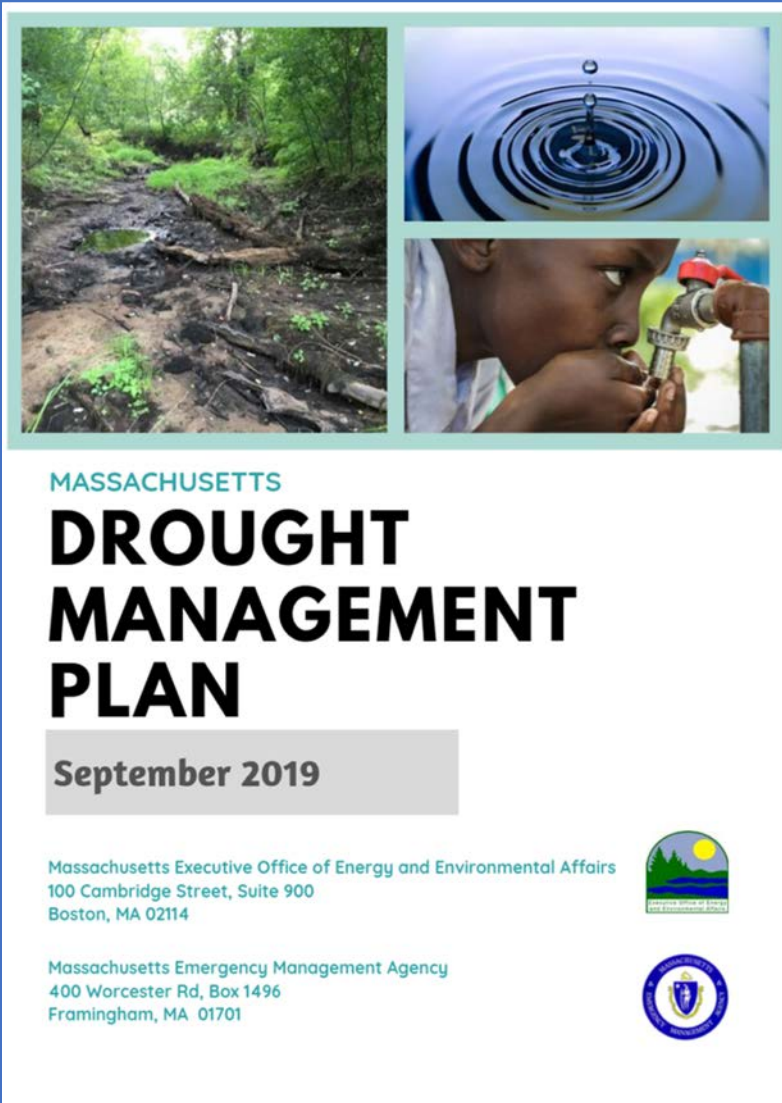


Why?

- Changing precipitation distribution?
- Increasing temperature → increasing ET?
- Increasing impervious surfaces → reduced recharge for groundwater and streams' baseflow?

Adapting to Faster Moving Droughts

- Revise indices in 2019 DMP
 - Earlier signaling of onset and intensification
- Understand temperature effect on available water → need new ET index





MASSACHUSETTS
**DROUGHT
MANAGEMENT
PLAN**

September 2019

Massachusetts Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

Massachusetts Emergency Management Agency
400 Worcester Rd, Box 1496
Framingham, MA 01701



Evapotranspiration (ET)

- Gravity Recovery and Climate Experiment (GRACE)
- National Water Model (NWM)
- Climate Prediction Center Soil Moisture (CPCSM)
- Evaporative Stress Index (ESI)
- Standardized Precipitation and Evapotranspiration Index (SPEI)
- Evaporative Demand Drought Index (EDDI)



Northeast Regional Climate Center

ET – Evaluation of Products

Logistics

- Spatial resolution - unique value per drought region
- Historical availability of data
 - for evaluating against past droughts
 - for calculating percentiles
- Update frequency (at least 1/week)
- Timely availability

Performance

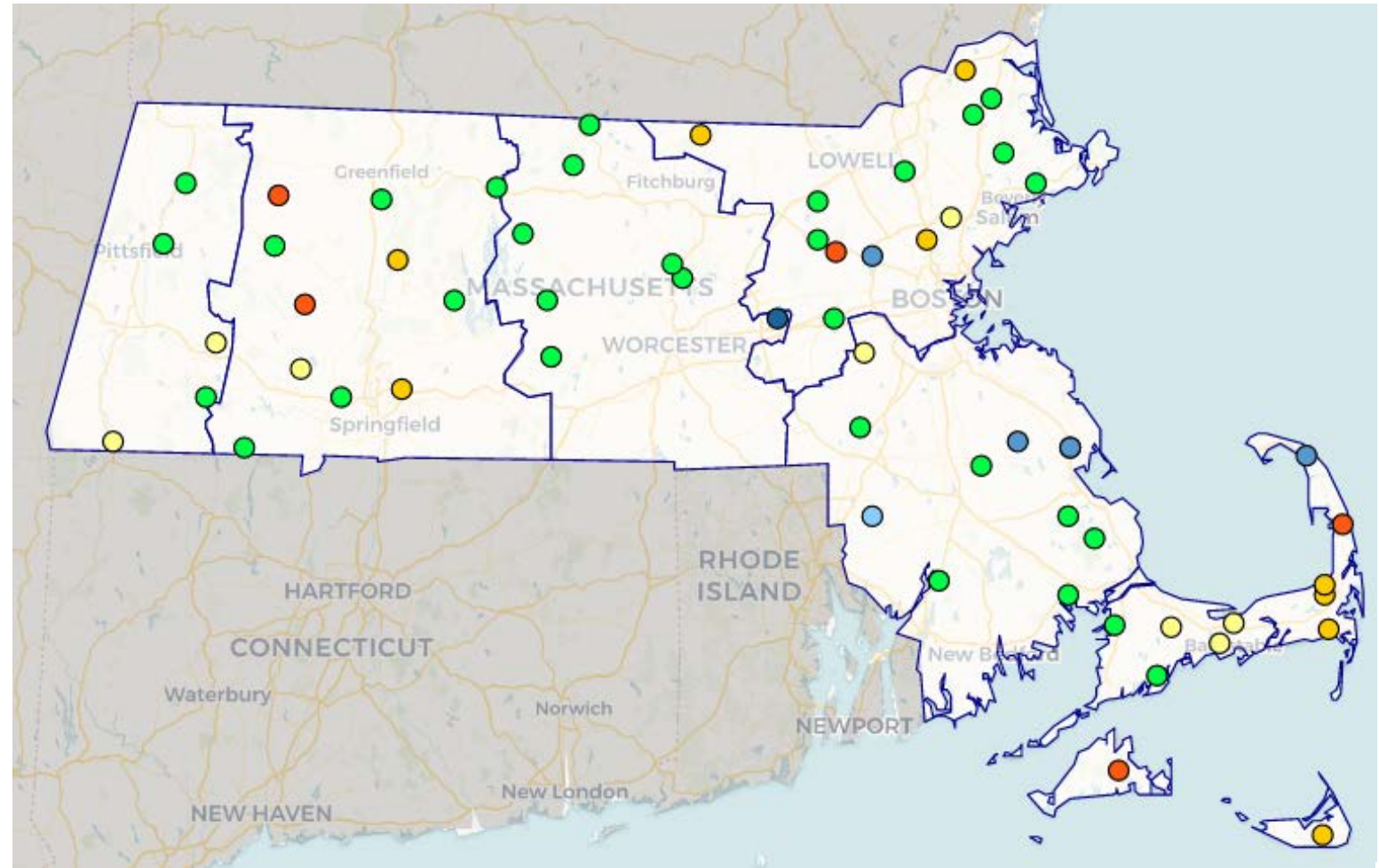
- Timely drought onset/intensification identification, especially when precipitation amounts are still near normal
- Effect of temperature/ET on drought

ET – Recommendation/Results

- EDDI is better than current index and other options at signaling the role of temperature and ET in drought
- Helps identify drought onset/intensification in a timelier manner especially when it is ET-driven rather than precipitation-induced
- Provides additional information to complement the other indices

More Real Time Monitoring

- By end of FY23, all MA CRN wells will be real time
- Will have real time data for
 - Precipitation
 - Streamflow
 - Groundwater
 - KBDI/soil moisture
 - ET



Almost Real Time Analysis – MA Drought Dashboard

- Manual monthly to automated monthly
- Added weekly

Home

---- Monthly Updates ----

- Precipitation
- Streamflow
- Groundwater
- Lakes/Impoundments
- KBDI

---- Weekly Updates ----

- Precipitation
- Streamflow
- Groundwater
- KBDI

---- Daily Updates ----

- Accum Precip Graph
- KBDI

---- Outlooks ----

- 7-Day Precipitation
- Monthly/Seasonal
- Monthly Drought
- Seasonal Drought

---- Other ----

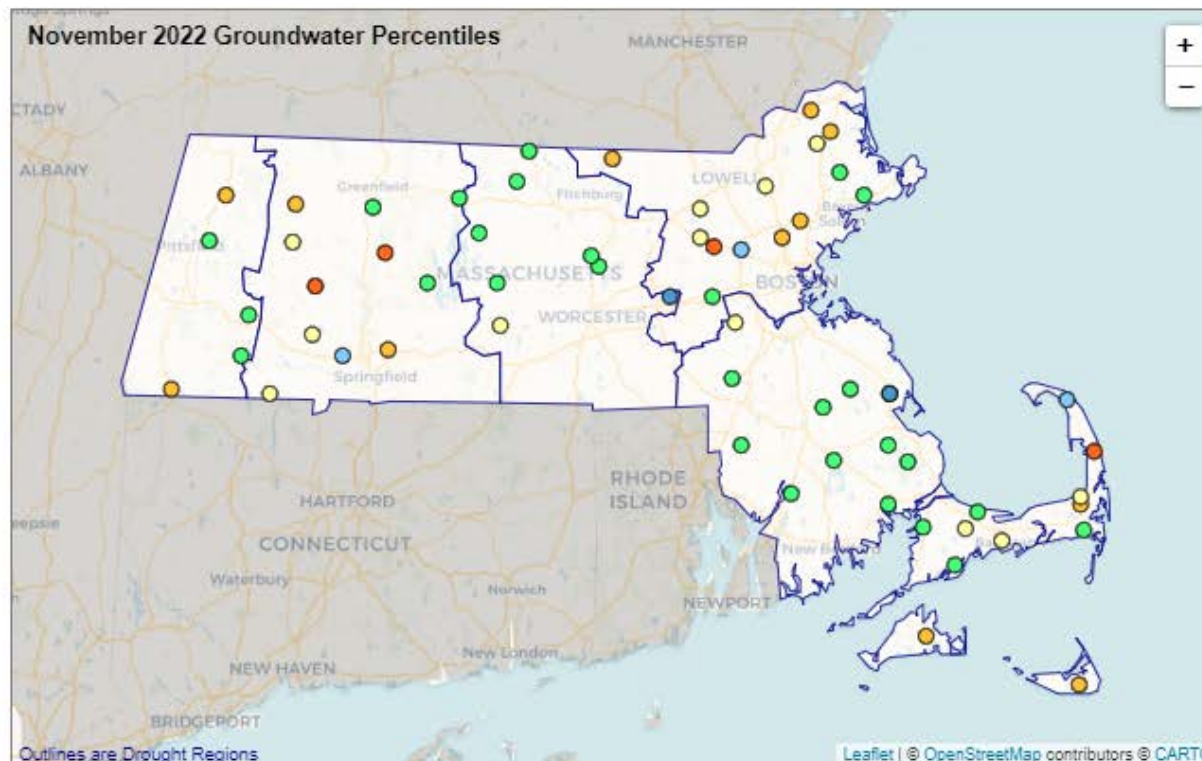
- Temp Departure Map
- Streamflow Pct Graph

Massachusetts Drought Dashboard

Groundwater Summary

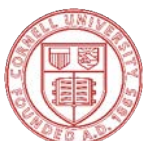
[View Individual Site Data](#)

Data may be provisional.



Point Values - Groundwater Percentiles

● ≥ 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	



MA Drought Dashboard Details

November 2022 Monthly Groundwater Summary

Shading indicates index severity level:

Level 0	Level 1	Level 2	Level 3	Level 4
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Region	Number of wells reporting	Median of individual well percentiles
Western	5	50
CTRV	11	24
Central	8	53
Northeast	14	22
Southeast	12	46
Cape Cod	10	28
Islands	2	14

Number of wells in percentile categories

Region	≥0 to ≤2	>2 to ≤10	>10 to ≤20	>20 to ≤30	>30 to ≤90	>90
Western	0	0	2	0	3	0
CTRV	0	2	2	3	4	0
Central	0	0	0	1	7	0
Northeast	0	1	5	4	4	0
Southeast	0	0	0	1	11	0
Cape Cod	0	1	1	3	5	0
Islands	0	0	2	0	0	0

MA Drought Dashboard Details

Groundwater

[View Summary](#)

November 2022 Monthly Groundwater Percentiles

Shading indicates index severity level:

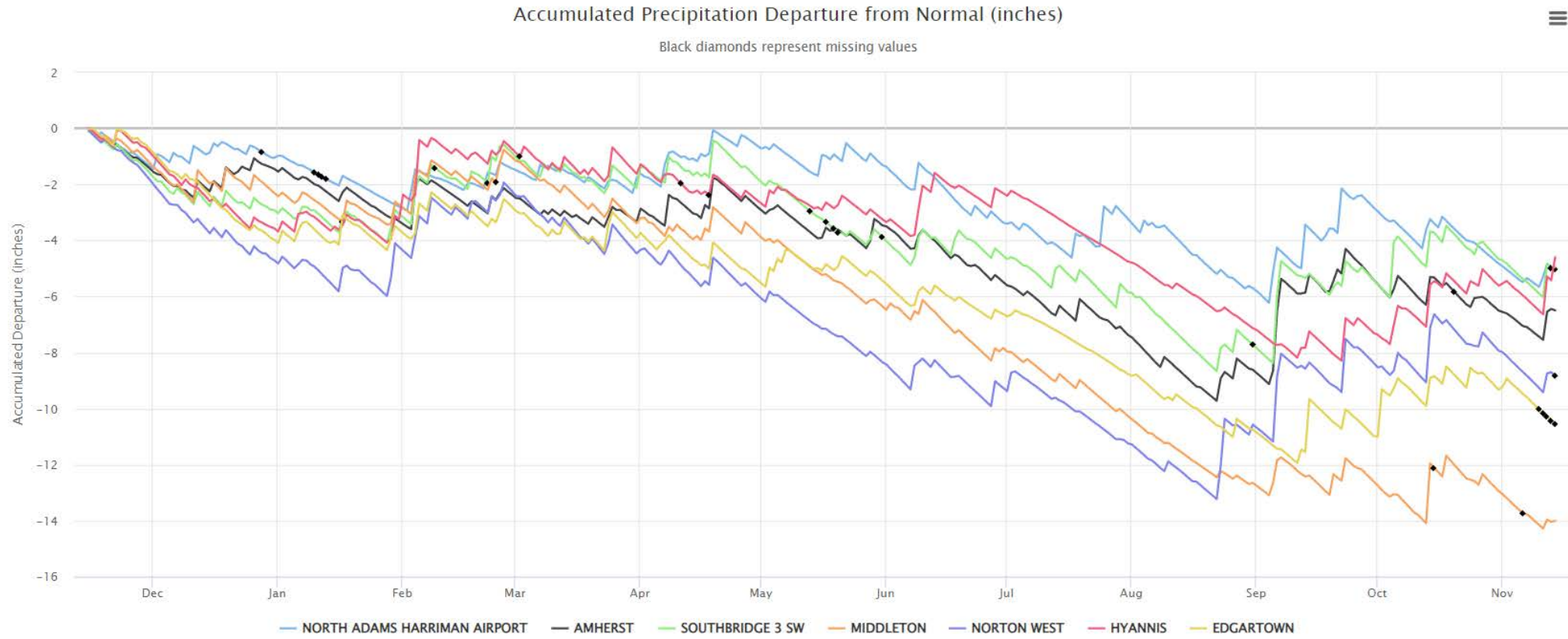
Level 0 Level 1 Level 2 Level 3 Level 4

Region/Site	ID	Groundwater (ft below ground surface)	Date	Period of record	Groundwater Percentile
Western					
OTIS	420912072042801	8.36	11/18	1964 - 2022	67
SHEFFIELD	420350073193601	13.84	11/24	1987 - 2022	20
PITTSFIELD	422745073112001	16.78	11/24	1963 - 2022	52
CHESHIRE	423503073075401	8.6	11/18	1953 - 2022	16
BECKET	421550073025101	3.11	11/18	1986 - 2022	50
CTRV					
CHICOPEE	421012072324301	23.54	11/24	1984 - 2022	15
PELHAM	422103072241103	4.68	11/24	1984 - 2022	38
SUNDERLAND	422559072332402	4.08	11/18	1983 - 2022	10
DEERFIELD	423311072355801	2.63	11/18	1965 - 2022	66
...

MA Drought Dashboard Details

---- Daily Updates ----

Accum Precip Graph



Accumulation start date

2021-11-15



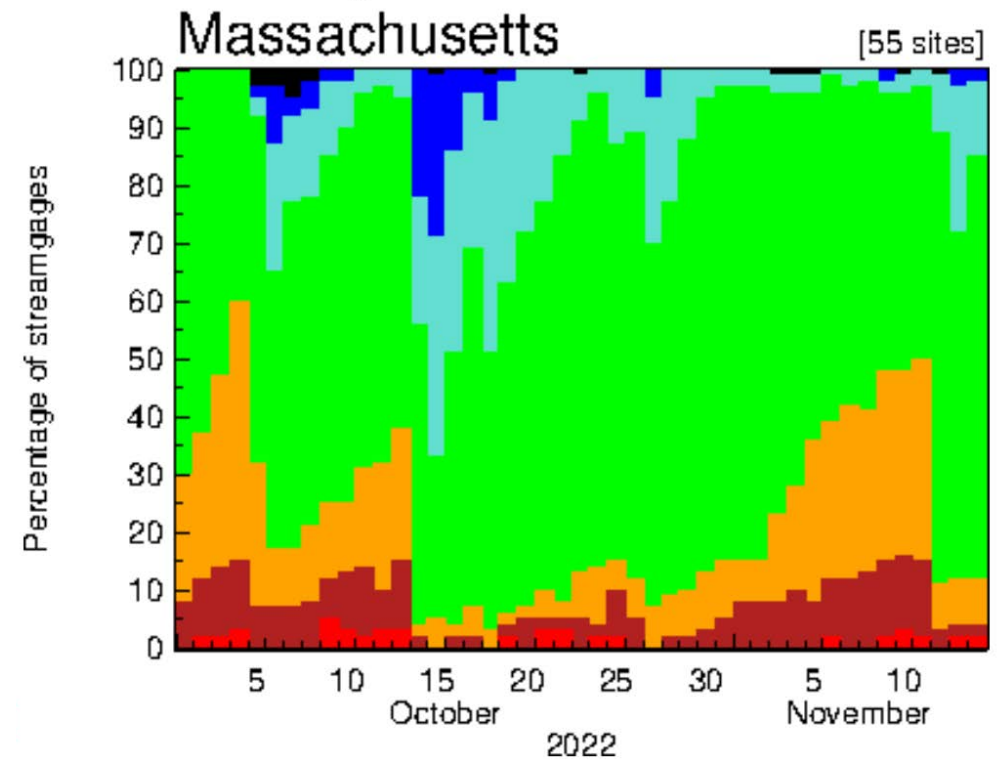
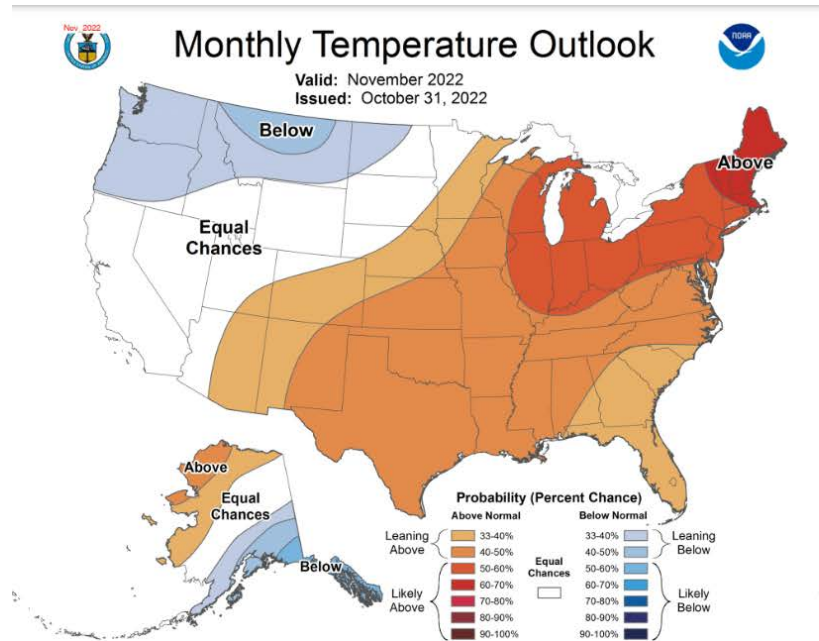
MA Drought Dashboard Details

---- *Outlooks* ----

- 7-Day Precipitation
- Monthly/Seasonal
- Monthly Drought
- Seasonal Drought

---- *Other* ----

- Latest USDM Map
- Temp Departure Map
- Streamflow Pct Graph



A close-up photograph of a person's hand reaching out towards the surface of water. The water is dark blue with light-colored ripples and reflections. The hand is positioned on the right side of the frame, with fingers slightly spread. The background is a soft-focus view of the water's surface.

Thank you!

Viki Zoltay

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